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Of BEEF TEA, DR. CHRISTISON says: "He was able to obtain but a *quarter of an ounce of solid residue in a pint*."

This solid residue consists of "besides the trifling amount of proteid mater- and of fat (which latter, in prac- e), is guarded against with great e), *only the salts of the muscle*, the *matin*, and *allied pigments*, *traces of sugar*, perhaps, *some lactic acid*, "and the nitrogenous extractives *crea-* "*tin* and its *congeners*. As the original "half pound of muscle may contain "about forty to sixty grains of the "salts, and ten to twelve grains of the "nitrogenous waste products, the beef "tea (half pint) certainly contained no "more."—PROF. BAUMGARTEN.

Of BEEF EXTRACT, DR. PAVY says: "There are grounds for believing that "a considerable proportion consists of "products of proteid decay, materials "in course of retrograde metamorpho- "sis, that are of no use as nutritive "agents."

The well nigh superstitious ideas entertained by the *laity* of beef tea, is expressed in the allusion to the "*strength*" which is popularly supposed to be extracted in the *tea;* after which the *beef* is thrown to the dogs. The working man makes soup from a joint and consumes the "strength" and the *beef* both.

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THE MODERN TREATMENT

OF

DISEASES OF THE KIDNEY.

—BY—

PROF. DUJARDIN-BEAUMETZ,

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TRANSLATED FROM THE FIFTH FRENCH EDITION BY

E. P. HURD, M. D.,

Newburyport, Mass.

1888.
GEORGE S. DAVIS.
DETROIT, MICH.

INTRODUCTION BY THE AUTHOR.

Dr Hurd has asked me for a short introduction to his translation of my lectures on the Therapeutics of Diseases of the Kidney.

The importance of a knowledge of this department of internal pathology and therapeutics is incalculable, and scarcely a day will pass when the physician in active practice will not have occasion to make application of some of the principles laid down in this treatise.

Much has been learned these late years as to renal pathology and symptomatology. We know to-day that one of the first results of fibroid degeneration of the vascular system (a morbid change so frequent), is sclerosis of the kidney, and this alteration entails renal insufficiency. In this insufficiency, the presence of albumen in the urine plays but a secondary rôle, and one which cannot serve as the basis of prognosis. Far different, however, is the case with that inevitable consequence of renal failure, the retention in the blood of toxic alkaloids secreted by the economy, and it is to the accumulation of these uro-toxines that we must ascribe that odd complexus of symptoms called uræmic poisoning.

Therapeutics may do much to oppose this systemic poisoning by favoring through other emunctories the elimination of these toxines.

I regret that the plan of my work forbade my devoting as much space as I would have liked to the consideration of this important therapeutic subject. But those readers of this work who desire more full information on the topics to which I have just alluded, would do well to read carefully

my lectures on "Prophylactic Hygiene," of which the advance sheets are furnished by me to my friend Dr. Hurd, and which are now in process of publication in the Therapeutic Gazette.

Despite these reservations, I trust that medical practitioners in the United States will find in these lectures many hints that will be of value to them in their practice, and I again express my grateful acknowledgements to Dr. Hurd, who has so carefully rendered my conferences, and to Mr. George S. Davis, the publisher, for giving to these lectures so large an audience in the great American Republic.

DUJARDIN-BEAUMETZ.

PARIS, FRANCE, Nov. 10, 1888.

PREFACE.

In the preparation of this little volume, the translator acknowledges his obligations to his daughter, Dr. Kate C. Hurd, Interne of the New England Hospital, who has rendered him assistance; while for all mistakes or imperfections in the translation, he assumes responsibility.

He also desires in this place to thank the author, who kindly provided him with the advance sheets of the Fifth Edition while it was going through the press, and thus enabled him to present to American readers a work which may be regarded as fully up to the times. This same favor was extended to the translator while the preceding volume on the "Modern Treatment of Diseases of the Liver" was in the course of preparation, so that both works may be considered as representing the latest advances. By this, and by similar acts of kindness on other occasions, Dr. Dujardin-Beaumetz has placed both the translator and the American medical public under lasting obligations to him.

NEWBURYPORT, MASS., Nov. 10th, 1888.

TREATMENT

OF

DISEASES OF THE KIDNEY.

CHAPTER I.

THE KIDNEY FROM A THERAPEUTIC STANDPOINT.

SUMMARY.—The Anatomy of the Kidney—Renal Epithelium—Theories of the Secretion of Urine—Theories of Wittisch and Küss—Ludwig's Theory—Bowman's Theory—The Kidney as a Selecting Filter—The Urine—Composition of Urine—Quantity of Urine—Solid Matters in Urine; Means of Recognizing Them—Urea—Process of Analysis for Urea—Chlorides—Method of Analysis for Phosphates—The Kidney from a Therapeutic Standpoint—The Elimination of Medicaments by the Kidneys—Importance of this Elimination—Rapidity of Elimination—Length of Time Occupied by this Elimination—Laws which Preside Over this Elimination—Dangers from Non-elimination—Toxic Action of Medicaments.

Before entering upon the study of the therapeutics of renal affections, I propose, as I have done in lectures upon the other organs, to sum up as briefly as possible the anatomy and physiology of the kidney, and I shall lay especial stress upon the clinical study

of the urine. I shall show you, in fact, that it is impossible rationally to treat diseases of the kidney without examining carefully and almost daily the modifications which take place in the urine. It is necessary for every physician to make this examination for himself, and you will see that in following certain rules, this examination is quite simple and easy.

You know the anatomy of the kidneys, you know their form and situation, you know the different elements which enter into their structure, and I will not dwell upon these points. Consisting essentially of the Malpighian bodies which are enveloped in the capsule of Bowman, the kidney may be considered as a mass of glomeruli, and of tubes which carry away the products which transude through these glomeruli.

The urinary conduits, you know, are of three varieties: the convoluted tubes (tubuli contorti); then tubes of smaller size called the loops of Henle, placed, so to speak, in the course of the tubuli contorti; finally, the straight, radiating, collector tubes (tubuli recti) ending in the calices of the renal pelvis.

The epithelium in all of these tubes plays a considerable rôle in urinary pathogeny; it is not the same throughout the whole extent of the excretory tube. Spheroidal in the first portion of the convoluted tubes, it becomes pavement in the descending branch of the loop of Henle, and finally cylindrical in the collecting tube.

Heidenham has made a complete study of the renal epithelium. He has shown, first, that the epithelium which

lines the Malpighian capsule is prolonged between all the capillaries. This endothelium is formed of flat membrane-like cells; the epithelium of the convoluted tubes is especially remarkable for the presence of little rods crowded against each other. These rods take the direction of the long axis of the cell, that is to say are perpendicular to the axis of the canaliculus. We do not yet know the function of this epithelium. That of the straight portion of Henle's loop is very regular, and has prominent nuclei in the descending part, but in the ascending portion we find again the epithelium with rods.

The difference in the characters of these epitheliums indicates a difference in their functions, and you will see when I come to the theories of urination, that physiologists have ascribed to these cell-elements no inconsiderable rôle.

Prevost and Dumas in 1823, showed that the urine is separated from the blood by the kidney, and what they then demonstrated, is to-day unattackable, despite the opposition made to these teachings by Oppler, Chrzonszezewsky, Zalesky and others. This view is based upon the experiment which consists, either in removal of the kidney, or in ligating the renal vessels, and we know that in these cases the urine must accumulate in the blood; this fact is moreover demonstrated to-day with all the scientific precision desirable by Grehant and Pawlinof, of Moscow. But to say that the kidney only separates the materials of the urine accumulated in the blood is not enough; physiologists have tried to go farther and explain the intimate mechanism of this filtration; hence three theories have been propounded.

The first is that of Wittisch and Kuss, who affirm that through the epithelial membrane covering Bowman's capsule, not only the urine filters, but albumen as well, and that the convoluted tubes which are a continuation of Bowman's capsule have for their function to absorb the albumen and allow the urine to flow off. In this event the kidney would be a veritable dialyzing organ, since, on considering the membrane of Bowman as a dialyzing membrane, we find it surrounded, above as below, by an albuminous liquid. You see also the great importance of the epithelium lining the convoluted tubes, as it is the function of this epithelium to absorb the albumen, and according to this view, in order that the albumen shall pass out in the urine, it is enough that these epithelial elements shall be altered or be wanting.

According to Ludwig's theory, the urine issues ccompletely formed from the blood plasma through Bowman's capsule, but it is very aqueous, and the epithelia of the convoluted tubes have for their function, not merely to return the albumen to the blood, but to absorb water as well, and thus concentrate the urine.

According to another theory, that of Bowman, the function of the epithelium of the convoluted tubes is also very important, for, in the view of this physiologist, water alone filters through the capsule of the glomerulus, and the epithelia of the convoluted tubes have for their office to secrete certain azotized matters,

and in particular urea. This theory, which is widely different from that generally accepted, gives to the convoluted tubes a rôle preponderating over that of the glomerule.

These views have been regarded as untenable by some, and have been adopted by others, but the experimental demonstration is still wanting. But at the same time, all are agreed, physiologists and clinicians, in attaching a considerable importance to the epithelium of the excretory ducts of the kidneys, and in admitting that here, in some sort, exists the key to the normal functions of the renal organs, and to the pathological troubles of urination. This epithelium, as Farabeuf has remarked, has its moments of inactivity and excitation; it grows old, like the rest of the organism, and as its period of activity is increased or diminished, we find more or less marked disturbances supervening in the economy; in a word, the kidney is indeed a filter, as Prevost and Dumas have said, but it is an intelligent filter, and if you will allow the expression, it is a selecting filter, *i. e.* it seems to choose out certain elements from the blood to eliminate them.

The importance of this function of filtration performed by the kidney is still further illustrated in the recent interesting researches of Gautier and Bouchard. Gautier has shown that in the normal state the animal economy is capable of producing alkaloids whose toxic properties are very great; these alkaloids (ptomaines and leucomaines) are normally eliminated by the

various secretions (sweat, saliva, and especially by the urine); if the renal secretion is below the normal, or is suspended, we can see the terrible danger to which the individual is exposed in whose blood products of extreme toxicity are accumulating.

The labors of Bouchard and Charrin have given the question a further extension, and according to the results of these studies it is not the ptomaines alone which are such deadly agents. Bouchard has attained to a new conception of uræmia, according to which this is a complex kind of poisoning, in which participate all the poisonous principles introduced into, or originating in the organism. When the quantity of toxic principles generated in twenty-four hours can no longer be eliminated in the same space of time by the kidneys, in consequence of the lessened permeability of these organs, then there is danger ahead.

But Bouchard has gone even farther; he has sought to establish the coefficient of the toxicity of different urines, and also to determine what are the substances which play the principal rôle. Attaching comparatively little importance to urea, to uric acid, creatine, leucin, tyrosin, xanthin, etc., he has ascribed a predominant part to the coloring matters, salts of potassium, and various other toxic substances, and thus, as I have told you, uræmia is, in his view, the result of several kinds of poisons, of which the characters differ as this or that substance predominates.

Bouchard has found in urine seven toxic principles:

1. A *diuretic*, urea, which is very slightly toxic, 5 or 6 grammes per kilogramme are necessary to kill a hare.

2. A *narcotic*, very poisonous, whose chemical composition is still unknown.

3. A *sialogogue* which produces an abundant sialorrhœa.

4. A contracter of the pupil.

5. A *hypothermisant* principle (*i. e.*, heat-depressor).

6. An *organic* convulsivant.

7. A *mineral* convulsivant, potassium.

These different poisons proceed from four sources:

1. From food.

2. From certain eminently toxic secretions, for example, saliva and bile.

3. From the disassimilation of the tissues and the waste of the organism.

4. From intestinal putrefaction produced by microbes which infest the digestive tube.

To establish the coefficient of the toxicity of urines, Bouchard made use of the hare for his subject, and he named the unit of toxicity necessary to kill one kilogramme of the hare's weight, urotoxia.*

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*If into the veins of the ear of a hare you inject twelve to fifteen cubic centimeters of normal urine, you observe myosis, acceleration of the respiratory movements, which diminish in amplitude as sleep comes on, lowering of temperature, and finally the animal dies in convulsions.

If you inject pathological urine, you see superadded a certain number of new phenomena: albuminuria, hæmaturia, and convulsions.

If after having evaporated the urine to dryness, you treat it with alcohol, and make a watery solution of the alcoholic extract, you notice that with the substances soluble in alcohol

As a result of his studies, Bouchard has been able to show that normal urine is much more toxic than urine of uræmic patients, which might have been foreseen, since the renal filter in the latter instance has ceased to eliminate the poisons, which are hence retained in the blood. He has shown also by this physiological experimentation that the urine of the waking state is more toxic than the urine secreted during sleep, waste during the waking period being greater.

But I cannot enlarge on this interesting subject, which has been so well set forth in Bouchard's later writings. Urine is one of the most important products of excretion in the economy; I cannot here go into a complete physiological dissertation on this liquid, and shall have to refer you therefor to your text books.

Yvon in the following table gives the composition of normal urine per litre during the 24 hours:

GENERAL CHARACTERS.

Quantity in 24 hrs	Man ...	1400 to 1500 grammes.
	Woman,	1100 to 1200 "
Consistence.....		Fluid.
Colour		Amber yellow or citron.

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there are produced somnolence, coma, diuresis, but not myosis nor hypothermia; there is also an abundant salivation.

If, on the other hand, you inject the substances insoluble in alcohol, you obtain myosis, fall of the temperature, and convulsions.

GENERAL CHARACTERS—CONTINUED.

Aspect	Transparent.
Deposits	None or flocculent, little abundant.
Odor	*Sui generis.*
Reaction	Slightly acid.
Density	1018 to 1022.

	Per Litre.	In 24 hrs.
Organic elements	26 to 27 grams.	35 to 36 gr.
Mineral "	8.5 to 10	12 to 14
Sum of substances in solution	13 to 37	52 to 62

ORGANIC ELEMENTS.

Urea	Man	18 to 24 gr.	25 to 38 gr.
	Woman	16 to 20	20 to 22
Uric acid		0.30 to 0.40	0.50 to 0.70
Hippuric acid		0.20 to 0 25	0.30 to 0.40
Creatin and Creatinine		0.40 to 0.80	0.60 to 1.20

MINERAL ELEMENTS.

Hydrochloric acid	4 to 5 gr.	6 to 8 gr.
Chloride of sodium	6.6 to 8	10 to 12
Sulphuric acid	2 to 3	
Phosphoric	1.66 to 2.20	
Lime	0.20 to 0.30	0.35 to 0.45
Magnesia	0.10 to 0.13	0.15 to 0.20

You know that urine presents a special composition, which makes this liquid, so to speak, consist of two urines; the one, solid, the most important, is com-

posed of azotized and mineral matters; the other, liquid, is the urine containing only water.*

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* Different authorities give different estimates as to the proportion of solids excreted in the 24 hours. Becquerel (French) gives the estimate at 39.52 grs.; Harley (English) puts it at 53 grs ; Lehmann (German) makes it as high as 67.82 grs.

Age and sex have a great influence on the solid elements of urine: thus children excrete proportionately more solid materials than adults, and women less than men, as the following table from Harley shows:

URINE OF 24 HOURS—AVERAGE WEIGHT 140 POUNDS, AGE 25 YEARS.

	MEN.	WOMEN.
Total amount of solids	53.00 grammes.	44.50 grammes.
Organic substances	36.00 "	31.00 "
Inorganic	16.40 "	13.50 "
Solid material for each pound of the body weight	0.37 "	0.35 "

These observations were taken on English adults of both sexes, and the table comprises the mean of four analyses.

According to Harley, pregnancy has a great influence on the excretion of solids, and the nearer you approach the time of delivery, the more these materials diminish.

In disease, you notice also generally a diminution. Among medicines, some increase, others lessen the quantity of these substances in the urine.

Among the first are opium, morphine, cicutine, hyoscyamus, Indian hemp, citrate of iron and quinine; among the second, digitalis, atropine, colchicum Alcohol and beer, according to Bocker, diminish the solids, while Rhine wine augments them.

Reptiles, and all animals deprived of a urinary bladder and having ureters opening directly into the rectum, render solid urines, and these urines only differ from liquid urines in the absence of water.

Urine, in the normal state, is always acid, and if it becomes neutral, it is only as Fustier has shown, before a meal;* it presents also a variable color, due, you know, to a singular coloring matter, urobilin, which is derived like bilirubin, from the coloring matter of the blood corpuscles, hæmatin; finally it contains among its nitrogenized materials very important substances, urea † and uric acid, which are the waste products of the organic combustions of the economy.

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* Bence Jones has claimed that there exists a compensatory equilibrium between the acidity of the urine and that of the gastric juice. According to him, the urine is at its minimum of acidity at the time when the stomach is at its maximum of acidity. Roberts has maintained that the urine becomes alkaline two or three hours after meals. Byasson affirms that the urine is least acid after the first meal, while the most acid urine is that of the night.

Neubauer and Vogel have adopted Byasson's view. Georges also holds that the alkaline reaction appears two hours after the meal. Delavand affirms, on the contrary, that the urine is acid during the entire day except in the morning, when it is generally neutral or alkaline. Finally, Fustier, who has made an important study of the reaction of urine, has shown that urine is always more acid after meals, and that its maximum acidity is about four hours after dinner; urine, on the contrary, is always neutral or alkaline about eight or nine o'clock in the morning, or before the ingestion of any food.

† Urea $CH_4 N^2O$ was discovered in human urine by Rouelle, in 1771, and obtained in a state of purity by Fourcroy and Vauquelin in 1779. It is formed in the blood, eliminated by the kidneys and is found in the urine of all animals; it exists also in the amniotic fluid, the aqueous humor, vitreous humor,

The quantity of urine is variable, and on an average, an adult man passes daily from 1200 to 1300 grammes of urine, representing 33 grammes of urea. The Germans and the English give a somewhat higher figure, which results from the dietetic habits of these two nations, who eat and drink more than we

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sweat, saliva, chyle, lymph (Würtz), in vomited matters, in pleuritic effusions, etc. It crystallizes in the form of silky needles, or of long, flat, four sided prisms, which are colorless, odorless, of fresh and pungent savor. Soluble in water and alcohol, scarcely soluble in ether, urea melts at 120° C. and is decomposed at 150° setting free ammonia, and leaving a white residue of cyanuric acid.

Urea combines with acids, oxides, and salts. If you add nitric acid to a concentrated solution of urea, you obtain nitrate of urea, in the form of white, lamellated crystals, sometimes in prisms, soluble in water and in alcohol. You obtain also, in a similar way, oxalate and hydrochlorate of urea. Wœhler has obtained urea artificially by the union of cyanic acid and ammonia. If, in the place of ammonia, you employ the ammonia compounds, you obtain products homologous to urea, which are described under the name of urea compounds (ethylurea, diethylurea, etc.). Finally, the name *ureids* is given to compounds of urea, with acid radical.

The average quantity produced by a male adult who lives on mixed diet and exercises moderately, is 18 to 23 grammes of urea to the litre of urine; in women the average is 15 to 25 grammes to the litre.

Harley, in his experiments, has found:

QUANTITY OF UREA IN URINE OF THE TWENTY-FOUR HOURS.

Boy of 18 months	8 to 12 grams.
Girl of 18 months	6 to 9 "
Man, 27 years	25 to 35 "
Woman, 27 years	20 to 30 "

do. But I believe, with Farabeuf, that we can lay down this law, that a man excretes by day and by kilogramme of his weight, one gramme of solid urine containing one-half gramme of urea.

If I am obliged to be brief on the physical and chemical properties of the urine, as well as on the modifications which it may present, I shall, nevertheless, be more explicit on the chemical means which enable us to analyze this secretion. Every physician ought to be competent to detect the principal elements of the urine, for without the ability to analyze or properly to test the urine, it is impossible for him ac-

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Nitrogenous foods augment the elimination of urea, all non-nitrogenous foods diminish it, and the experiments of Von Franque show clearly the influence of a purely animal diet:

KIND OF FOOD	UREA IN 24 HRS.	UREA PER HOUR.	FOR EACH POUND OF WEIGHT OF BODY.
	Gr.	Gr.	Gr.
Animal (3½ lbs. meat)	92	3.86	0.53
Mixed.....	87	1.58	0.21
Vegetable.....	28	1.08	0.15
Non azotized..	16	0.69	0.09

Certain medicines augment the elimination of urea; such are: the alkaline chlorides, iron tonics, preparations of squill, juniper, etc. Others diminish the elimination; such are: coffee, tea, alcohol, preparations of mercury, digitalis, and valerian.

Disease has a great influence on the production of urea; in febrile affections near the onset, in diabetes, you notice a marked increase; the contrary takes place in chronic diseases, cardiac affections, anæmia, cirrhosis, dropsy, cholera, scurvy, etc.

curately to diagnose the renal affections and prescribe a proper course of treatment.

How can you determine the amount of solid materials? Do not forget that this is a very important point; the solid urine is the true urine; water is only the vehicle, and represents but a secondary element. One patient, for instance, who passes a great deal of urine, in reality passes but little, for this enormous amount represents almost exclusively water, while another patient, despite a consderable difference in the quantity of liquid excreted, really urinates sufficently, because his urine contains a large amount of solid material.

To obtain the proportion of solid materials, there are methods which are quite easy; you have only to know the density of the urine, and to arrive at this result, you require a urinometer. You may even dispense with a urinometer; you need only to know the weight and the volume of urine to know its density, since you know already by the laws of physics that the weight equals the volume multiplied by the density; to know this last, it suffices then, to divide the weight by the volume.

The density of urine averages 1020, and whenever it is below this figure, the urine is said to be light, and to contain little solid material. To know exactly the quantity of solids in one litre of urine, it is sufficient to multiply by 2, the last two figures of the density. Thus, here is a urine marking 10.18, the

quantity of solids would be 36 grammes per litre. This figure 2, however, is not absolutely exact, and to render it such, it is necessary as Yvon has shown, to multiply not by 2, but by 2.33.* You are now able with the help of the figures I have given you to obtain with almost mathematical accuracy the weight of the solid materials voided in twenty-four hours by the patient; for this purpose, it suffices to know the density and volume of the urine. Multiply first the two last figures of the density by 2.33; multiply the result by the volume, and divide by 1000. This figure will represent exactly the solid materials contained in the quantity of urine which you are examining. After having thus pointed out the method of finding the quantity of solid urine, there is no more useful study than that of ascertaining the amount of azotized materials contained in the urine; these materials, in fact, indicate in a precise manner the state of the organic combustions; you know also that when they accumulate in the blood, they determine in the economy a series of grave phenomena to which the attention of the physician must be directed, when he is called on to treat renal affections. It is then neces-

* Here is a general formula which makes known the weight of the solids in a given quantity of urine: x represents the weight sought; D the two last figures of the density of the urine; V the volume of the urine.

$$x = \frac{D \times V \times 2.33}{1000}$$

sary that you should be able to detect easily these azotized substances, and particularly the urea which forms the far larger part. What are the methods to be employed in such cases?

Three processes are in usage; that of the balance, that of precipitation by means of certain standard liquids, and, finally, that of volumetric analysis.

The last, the only ready and rapid method, is the one to which you should resort. It is based upon the fact that urea, in presence of certain bodies, decomposes into nitrogen and carbonic acid, and it will be sufficient to ascertain the quantity of gas produced, to know the quantity of urea corresponding to it. Three substances give rise to this decomposition; nitrous nitric acid, the hypochlorites and the hypobromites.

The nitrous nitric acid (Millon's reagent) (1) has been used by Hétet, Gréhant and Bouchard. It is a process which has the inconvenience of demanding either the use of the balance, or of chloroform which renders it too expensive and too slow for ordinary clinical examination.

Lecomte was the first to employ the alkaline hypochlorites; it was an advance on the old methods, but still offered a serious inconvenience—the slowness of the operation, which demanded several hours for its production.

The hypobromites were introduced simultaneously into France by Yvon, and into Germany by Knopp and Huffner; it is the best process; it is prompt, rapid and not costly. (2)

You make use of an alkaline solution with this composition:

℞ Bromine, 5 cubic centimeters.
Strong lye (of soap makers),* 150 grammes.
Distilled water, 100 grammes.

This strongly alkaline solution absorbs the carbonic acid set free in the reaction, and it is by the volume of nitrogen produced that you judge of the quantity of urea contained in the urine.

To measure the quantity of nitrogen, you may employ the process of Yvon, of Esbach, or of Regnard, ingenious processes which enable us to make the analysis with sufficient rapidity. Certain tables constructed according to known laws, tables with which every clinical laboratory should be furnished, indicate to you when once the volume of gas is known, what is the quantity of urea contained in one litre of the urine.

You see me every day employ these processes; you have noticed their ease and readiness of management, and I hope that you have derived therefrom this conviction that every physician, however little accustomed to the manœuvres of the laboratory, may quickly comprehend and execute these various procedures.

I know that there have been advanced numerous

* From wood ashes. It is a strong solution of caustic potash. Tr.

objections, that it has been said that these were but approximative processes, giving not the figure of urea merely, but that of all the azotized materials, that, moreover, these processes are incomplete. I acknowledge the justice of these objections from a purely chemical point of view, but from that of clinical therapeutics, the only one which we ought to take into consideration here, these procedures are excellent; they enable us to establish with sufficient exactness the quantity of of urea in the urine, and especially to know whether this quantity augments or diminishes in the same patient. We ought then to thank those who have taught us these easy methods of analysis, since they have so contributed to the study and thereby to the treatment of renal diseases.

The examination for chlorides presents also a certain importance, though less than that for urea, and may render us some service. There is a process by standard solutions which is very simple and handy; it consists in precipitating the chlorides by nitrate of silver. To render this precipitation more visible, you add to the solution a little yellow chromate of potassium, which takes on an orange-red color when this precipitation is complete. You can, as Duhomme shows, use the ordinary gauged dropping tube, (3) and into two cubic centimetres of urine to be examined, you add a drop of yellow chromate of potassium; upon this mixture you let fall drop by drop a solution of silver nitrate made as follows:

℞ Argenti nitratis, 11.63 gr.
Water, q. s., ut. ft., 100 c. c.

It will be sufficient to count the drops which have been employed in order thus to bring the liquid to the orange-red, and to refer to the table constructed for the purpose, to know the quantity of chlorides contained in one litre of urine.

The analysis of the phosphates is more important than that of the chlorides, but this examination (4) is more difficult. There has not yet been found a really good clinical process to determine the amount of phosphates, and their dosage remains still more in the province of the chemist than in that of the physician.

Such are the methods of rapid analysis of urine; these methods, you see, demand an instrumental outfit which is very simple and inexpensive; dropping tubes, Esbach's or Regnard's apparatus, a urinometer, some test papers, this is all the equipment necessary. As to the operative procedure, it is very simple, and it is sufficient to have practiced or to have seen practiced once or twice these analyses in order to be able to obtain for yourselves positive results. You will see, gentlemen, in the course of these lectures, how necessary, and I would even say indispensable, these studies are.

Until now I have been occupied only with the urine and the examinations which enable us to detect and measure the principal materials which it contains,

but there is another very important question which I must not omit, that is the study of the kidney considered from a therapeutic point of view.

When I was on the subject of the liver, I showed you that in respect to medicaments there are two points to be especially studied, the one concerning the augmentation of the biliary secretion and pertaining to cholagogues, the other, still less known, and relating to the elimination or fixation of medicaments introduced by the digestive tube into the hepatic gland. Similar considerations apply to the renal gland, and their study presents a great interest from a therapeutic point of view.

Of all the emunctories whereby medicines are eliminated, the most important, and the one most constantly in exercise, is the renal, and despite numerous gaps in our knowledge, this emunctory is the one which is studied the most. To examine the medicines which pass out in the urine, to dose the quantity, to note the rapidity with which this elimination is effected, to know in what chemical state they are thus voided, this is to follow step by step the action of these medicines in the organism. Therefore I do not know any study more interesting, and I believe that the question which was propounded some years ago by the Medical Faculty of Heidelberg (5) deserves to be studied anew, because it is in this study, as Bouchardat has said, that we shall find the key to the pharmacodynamic action of medicines.

In order fully to state what we know respecting the elimination of medicines by the kidney, several lectures would be necessary, and I can here only trace the principal elements of this great problem of therapeutics, a problem not yet solved, but which presents nevertheless, interesting points, and which you ought to know.

When medicines are introduced into the system, whether by the skin, lungs or stomach, they enter the general circulation; then, after a time, they are eliminated, and a large number of them pass off by the kidneys. But how various are the modes of elimination of medicinal substances by the urine! Some pass out without any appreciable alteration; such are the sulphates, chlorates, a great number of alkaloids, alcohol, etc.; others undergo profound modifications, these are chiefly the citrates, tartrates, and in general the vegetable acids and their salts, which are eliminated, as Wöhler has shown, as carbonates. Certain substances undergo a more or less complete oxidation. Such are the sulphides, which pass out in the urine in the state of sulphates; there are some that combine with certain elements of urine, as salicylic acid, which Bertagnini has shown us, is eliminated in the form of salicyluric acid. Other remedies are decomposed, and while the volatile substances are eliminated by the lungs, the fixed parts are excreted by the urine. This is what happens in the case of the terebinthinates; these substances are constituted, as

you know, by the union of an essence and a resin, and we see, for example, in the oleo-resin of copaïba, the volatile oil pass out by the lungs, while the copaïvic acid is excreted by the kidneys and exercises its medicinal properties upon the urinary passages (6). Finally, other drugs, like rhubarb and senna, in being excreted with the urine, give it a special color (7).

This passage through the kidneys of medicinal substances takes more or less time, and while there are certain substances which require five to eight days to be eliminated completely, like iodide of potassium, we see others which take months for their elimination, such as mercury, for instance, and this difference gives us an explanation of the dissimilar action of the medicaments.

Medical writers have tried to refer to physiological laws this slowness or this activity in the elimination of medicaments by the kidneys, and Gubler has formulated this general rule, that medicinal substances are the better accepted by the economy, the nearer they are like the chemical principles which make part of the organism. According to this theory, substances similar to those which the humors contain are tolerated in greater proportion and are eliminated slowly, while, on the contrary, heterogeneous substances are badly supported and rapidly eliminated. Thus it is that the salts of sodium are better tolerated than the salts of potassium, the chlorides than the bromides.

While recognizing the exactness of this law in a certain number of cases, I believe that it would be difficult in the actual state of our knowledge to generalize it so as to cover all medicinal substances; for we see certain substances like mercury, arsenic, etc., which have nothing like them in the economy, and which according to this rule, ought to be rapidly expelled, require a long time for their elimination.

However, if we cannot yet establish the rules which should govern the tolerance or intolerance of drugs by inquiring into their elimination, whether more or less promptly performed by the renal passages, we know nevertheless, an important factor in the elimination of medicines : the dependence of this elimination on the normal permeability of the kidneys. Already in my Diseases of the Heart * I have told you that one of the contra-indications for injections of morphine is an impermeable state of the kidneys; we have here a circumstance on which it is well that I should insist anew.

For a long time certain authorities, as Hahn, Guilbert, Rayer, Corlieu, had observed that in certain cases of Bright's disease, substances taken into the stomach which in the normal state impart a characteristic odor to the urine, such as turpentine, asparagus, no longer in such patients give rise to this odor. De Beauvais had collected many such facts in his thesis, in which he calls attention to the want of elimination of odorous substances by the urine in Bright's disease.

* Diseases of the Heart, (Library Edition, Detroit, 1887).

But it is to Prof. Bouchard that the honor belongs of having clearly set fort this fact that in nephritic patients the elimination of medicinal substances no longer takes place by the kidneys, and hence they rapidly and in small doses determine toxic phenomena. He thus brings together and coördinates facts previously scattered in medical literature, facts such as that reported by Todd, who noted poisoning in a gouty patient by a small dose of Dover's powder; such as that of Robert, who witnessed mercurial poisoning in a patient affected with Bright's disease after small doses of mercury; Keen and Dickinson have, moreover called attention to like facts. Since then, observations have been sufficiently numerous to justify the affirmation that it is dangerous to prescribe very active medicinal substances for patients whose kidneys are so far altered that elimination is wholly or in part arrested, and the danger is far greater when use is made of the hypodermic method.

This question of permeability of the kidneys comes up anew in connection with salicylic acid, and has been one of the most serious arguments to allege against the introduction of this acid as a means of preservation of alimentary substances.

By availing themselves of the anti-fermentative properties of salicylic acid, brewers and wine merchants may, as you know, prevent beers and wines from spoiling, but if these beverages thus sophisticated with salicylic acid may be taken without much, if any

harm by individuals whose kidneys perform their functions normally and actively, owing to the rapid elimination of this acid, it is not so with persons whose kidneys are diseased or in any way functionally incapacitated, in which event morbid accidents of a grave character supervene. Brouardel has shown us that, while in a young and healthy subject salicylic acid appears in the urine a few minutes after the absorption of this acid, in an old person, on the contrary, elimination by the urine is more tardy and does not declare itself till the next day, or even the second day after ingestion of the medicament.

In the Lectures on Diseases of the Liver, I pointed out to you the clearly marked differences which exist between the action of a medicine introduced by the skin, and by the stomach. Medicines introduced subcutaneously, I told you, pass immediately into the circulation, and are eliminated principally by the urine, while medicines taken by the mouth pass to the liver, and may there undergo modifications more or less profound.*

You at once comprehend the application of this fact to the particular case of alteration of the kidney, and you understand that every subcutaneous injection of an active principle may produce symptoms of poisoning, even though it may have been administered in small doses.

Such, gentlemen, are the principal considerations

*Geo. S. Davis' Library Ed , p. 9, etc.

dependent on this great fact of the elimination of medicinal substances by the kidney; they have, you see, a capital importance; so we have been able to complete the old adage *corpora non agunt nisi soluta* by this: *corpora non agunt nisi secreta.*

What important discoveries would be made, what problems of therapeutics would be solved if physicians would take up anew, with all the scientific rigorousness which improvements in chemical and physiological studies permit, this question of the elimination of medicines by the urine? Hence it is that I cannot too much call the attention of the rising generation of physicians to this fruitful field of investigation, so full of promise and success.

NOTES.

1. Millon's test is prepared by dissolving 125 grammes of mercury in 168 grammes nitric acid, density 144, then by diluting this solution with twice its volume of water. Poured into the urine, this reagent decomposes the urea, giving rise to two volumes of carbonic acid gas and nitrogen. Into a tube with a bulb in the middle, weighed before hand. and containing a solution of caustic potash. you pass these mixed gases; the Co^2 is absorbed by the potash, and its weight equals the increase of weight of the tube. Then, in multiplying the weight of the carbonic dioxide by 1 3636, you obtain the weight of the urea contained in the urine which is being tested.

2. Instead of giving a lengthy note by the author, describing Yvon's French process for the quantitative analysis of urea (a process which might not be easily made intelligible without suitable diagrams) the translator has taken the liberty of giving two peculiarly American methods, those of Dr. Green, and of Prof. Doremus. The communication of the latter was made to the New York County Medical Association.

EXHIBITION OF A NEW AND SIMPLE APPARATUS FOR DETERMINING THE QUANTITY OF UREA IN THE URINE.*

Dr. Charles A. Doremus, Professor Adjuvant to the Chair of Chemistry and Toxicology in Bellevue Hospital Medical College, presented a new ureometer which he had devised. It is a glass instrument consisting of a tube bent into two arms, a longer and a shorter one, at an angle of forty-five degrees to each other. The extremity of the longer arm, on which a graduated scale is marked, is closed, while that of the shorter one, which is provided with a bulb, is left open. The long arm is filled, by inclining it, with a hypobromite solution prepared according to the formula of Knapp, by dissolving 100 grammes of sodium hydrate in 250 cubic centimetres of water. By means of a nipple pipette a measured volume of the urine (1 cubic centimetre) is injected slowly up the long arm by compressing the nipple. A rapid decomposition of the urea takes place, the bubbles of nitrogen rising in the long arm, while the displaced liquid flows into the bulb, which serves as a reservoir. With care the urine may be delivered at a rate that permits the decomposition to take place without loss of gas, and the graduation on the glass indicates the weight of urea in the urine used. Two forms of the apparatus were made, Dr. Doremus said: one graduated to real fractions of a gramme, the other to show grains of urea in the fluid ounce of urine. The instruments were supplied by Messrs. Eisner and Amend, of Third Avenue and Eighteenth St., New York.

Dr. A. Flint, Jr., said that he was glad to be able to make some remarks on the beautiful demonstration made by Prof. Doremus. It was a thing to rejoice in whenever any addition was made to the simple methods in our possession of obtaining important results, and he thought that no more important matter could be brought to the attention of the busy practitioner than such a one for determining the quantity of urea as Prof. Doremus had just presented to the Association. If looked at from a practical point, excessive accuracy in this procedure was not a matter of importance. It was useless, and worse than useless, to attempt to secure excessive accuracy in such manipulations. The important points which the practitioner usually required to know in regard to the urine of his

* From the Medical News, March 25, 1885.

patient were very few, and, thanks to the present achievement of Dr. Doremus, very simple means were now at his command for obtaining them all. In the first place a ready test for sugar was afforded by the two solutions of Dr. Squibb. The method was absolutely perfect, and by means of it the absence of sugar, which was always a more delicate matter to determine than its presence, could be positively demonstrated. In the second place, no better tests for the detection of albumen were required than the cold nitric acid test, conjoined with heat, if care was taken to have the urine under proper conditions when making the examination. In this connection he mentioned an interesting case which had come under his observation as a life insurance examiner. There was some question as to whether there was albumen in the urine or not, and on the application of heat there was a slight, but distinct, precipitate. This was undoubtedly caused by phosphates, for when nitric acid was added it cleared up; but there then followed a slight precipitate which was due to albumen. With the cold nitric acid test there was, after the urine had been set aside for two or three minutes, the characteristic white zone between the nitric acid and the urine floating above it. In the third place, the question of the amount of urea arose. The practitioner wanted to know how much urea there was in the urine of his patient, so that he could judge whether the kidneys were doing their work properly in throwing off a sufficient quantity of excrementitious products. He had long felt the want of some easy way of determining this, and the apparatus which had just been exhibited seemed to him to meet the case precisely. He, therefore, regarded it as one of the most important contributions which had been presented to the profession on the subject. In conclusion, he said he should like to ask Dr. Doremus whether it was essential that the soda of the alkaline solution should be exactly in the proportion of six ounces to the pint of water. Dr. Doremus replied that the caustic soda solution should always be in excess. The quantity of alkali might be greater than this but it was never to be below it. The determination of the amount of urea of course is only approximated by this method.

SIMPLE FORMS OF APPARATUS FOR ESTIMATING THE QUANTITY OF UREA IN THE URINE.*

BY AUSTIN FLINT, JR., M.D., LL.D.

At the request of Dr. William H. Greene, of Philadelphia, I have the honor to exhibit to the Association his apparatus for the estimation of urea. The request is contained in the following letter from Dr. Greene, and the description of the apparatus was sent to me by Dr. Greene, with the apparatus itself:

I see that you have favorably noticed a ureometer exhibited by young Dr. Doremus to the New York County Medical Society on the 16th March. As you may possibly have noticed in a reclamation of priority, which I published in the Medical News of the 4th inst., I consider that Dr Doremus has acted either ignorantly or with but a slight appreciation of the ethics of scientific men in seeking to appropriate credit for an apparatus of which the only simplicity—the absence of stopcocks—is due to myself. At the same time he does not appear to comprehend the importance of corrections for temperature and pressure even in approximate measurement of gases

I send you by express a ureometer, which please accept with my compliments, and compare with that of Dr. Doremus.

I have made no advertisement of the instrument. My deceased friend, the late Adolph Wurtz of Paris, presented for me its description to the Académie des Sciences. Greiner and Friedrichs began manufacturing it immediately afterwards, and, at my request, sent me seven. This one, which I send you, is the third that I have presented, the other two having been given to personal friends.

I would esteem it a favor if you would either read this note or exhibit the apparatus to the New York County Medical Society.

Very respectfully yours,

WM. H. GREENE,

3235 SANSOM STREET, PHILADELPHIA, April 18, 1885.

"A SIMPLE APPARATUS FOR ESTIMATING UREA. By W. H. GREENE. (Fresenius, Zeitschrift für Analyt. Chemie, xxiii. Heft ii. S. 275.)

"A simple apparatus for estimating urea with sodium hypobromite, which has been suggested by W. H. Greene is intended for clinical purposes, and admits of rapid work. Its essential part is the glass vessel *a* (see Fig. 1), whose under

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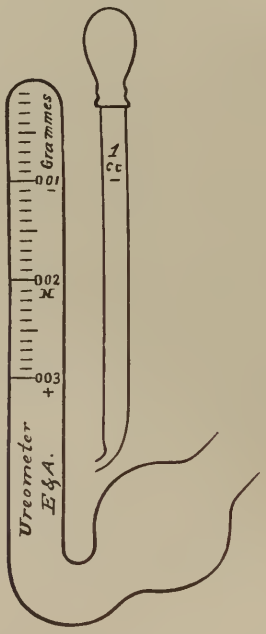
* Read before the New York County Medical Association, May 18, 1885. Medical News, May 30th, 1885.

portion, holding about 60 cc., has a side-tube, while the upper cylindrical portion, of from 20–25 cc. capacity, is graduated.

Fig. 1.



"To make the determination, a measured quantity of urine is introduced by means of the pipette, whose end has been bent, into the glass vessel, which has been filled with hypobromite and placed in a saucer to catch the ley that escapes.

"The nitrogen produced collects in the graduated cylinder. It is advisable to choose a pipette whose fine end allows 3–4 cc. of urine to escape in a minute.

"When the decomposition is complete, a bent funnel-tube is inserted in the tubulus, and this is filled with hypobromite to the same level as that in the graduate. The reading of the volume of nitrogen is then made. If it is desired to do away with the funnel-tube, the entire apparatus may be sunk in water until the level of the hypobromite corresponds with that of the outside water.

"Quantity of urea in a litre of urine =

$$\frac{1000\ v\ (h - h')}{760 \times 354.3 \times a\ (1 + 0.00366\ t)}$$

"v = volume of gas.

"h = barometric pressure in millimetres.

"h' = tension of aqueous vapor in millimetres at temperature t.

"a = volume of urine employed."

To enable members of the Association who were not present when the apparatus constructed by Dr. Doremus was presented, to make a comparison between the two methods, I take the liberty of exhibiting again Dr Doremus's process. It is proper, however, to state that Dr. Doremus makes no claim to originality, as is shown by the following extract from the *Journal of the American Chemical Society*, vol. vii, No. 3:

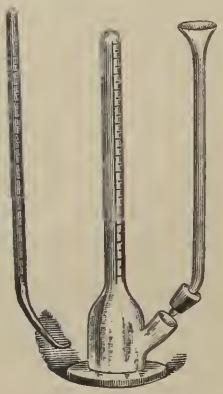
"The general form of the apparatus shown in the cut (Fig 2) is not new. It was in use in Prof. Kuehne's laboratory in Heidelberg in 1871, where it was employed in the detection of fermentable sugars by introducing some yeast in the liquid, and setting the tube in a warm place. The carbon dioxide evolved collected in the long arm.

"Since then it has been given in works on animal chemistry."

"The long arm of the tube is filled to a point marked = with a solution of sodium hydrate, six ounces to a pint of water, and one cc. of bromine is then added by means of the pipette. This extemporaneous mixture, for each analysis, is made in the apparatus itself, for the reason that the hypobromite is liable to deteriorate. Enough water is then added to fill the long arm and bend of the ureometer. One cc. of urine is then passed slowly into the apparatus by means of the pipette, and the quantity of gas liberated is read from the

scale, which gives the actual proportion of urea, without calculations or the use of tables. The determination can thus be made in nearly the time that has been required for its description.

FIG 2.



Each of the two forms of apparatus is designed to present a convenient and rapid application of a well-known method for the quantitative determination of urea. There seems to be no ground for controversy as regards originality or priority; and practitioners will undoubtedly select the apparatus which is most convenient.

Dr. Doremus presented, by request, at a previous meeting of the Association, the form of apparatus which he uses in teaching, as possibly the simplest and most convenient for medical use. The graduation was made experimentally, at a temperature of 65° Fahr., with a uniform volume of liquid, so that, these requirements and conditions being fulfilled, the estimates are sufficiently close for all practical purposes, and "corrections for temperature and pressure" are unnecessary.

3. This is M. Duhomme's process for the analysis of

the chlorides of urine by the method which he has described under the name of *clinical urochlorometry*. As apparatus, the ordinary test tubes are all that is needed, and two droppers, the one guaged to hold 2 cub. c. m. of urine, the other one for a standard solution of silver nitrate (see text, page 19). Each drop of this solution corresponds to 1 gram of chloride of sodium to the litre. The operative procedure is as follows: You examine first the reaction of the urine by the litmus paper. With a dropping tube graduated for 1 c. m. you count the number of drops contained in 1 cu. c. m. of urine, then with the other graduated dropper you measure as nearly as possible 2 cu. c. m. which you pour into a test tube, and add one drop of a solution of chlorate of potash, then pour into this test tube drop by drop, the solution of silver nitrate, taking care to shake the tube each time that you put in one drop of the standard solution until this mixture takes on a brown color like that of coffee and milk. Now count the number of drops employed, and by referring to the following table (p. 34) you have the quantity of chlorides contained in one litre of urine.

The Roman figures of the table represent the number of drops of urine contained in 1 cu. c. m. The Arabic figures apply to the number of drops of the silver nitrate solution used.

When the urine contains albumen it is necessary to precipitate it before testing for the chlorides.

4. A long note by the author on the modern mode of testing phosphates by standard solutions of uranum nitrate, ferrocyanide of potassium and acetate of sodium, is omitted for want of room.

The dosage of the phosphoric acid in the urine is effected by means of a definite solution of uranum nitrate, which precipitates this acid as an insoluble phosphate; when all the PO^3 is precipitated a drop of $K^2 FeCy^3$ solution colors the urine red.

Phosphate of lime and phosphate of magnesia are soluble in acids, and therefore are not deposited in acid urines; they are excreted to about the extent of 1 gramme per day. When present in the urine in large quantity, they are precipitated as an abundant white sediment, the urine being neutral or alkaline to test paper Phosphate of lime occurs as an amorphous powder, sometimes also in crystals, often forming beautiful star-shaped masses. Ammoniaco-magnesian phosphate (triple phosphates) is one of the most common deposits;

it is deposited from alkaline urine in colorless prismatic crystals of various sizes, tending to the coffin-lid shape. These crystals are soluble in acetic acid.

TABLE FOR THE UROCHLORMETRIC ANALYSIS.

Number of drops of the solution of silver nitrate.	Number of drops in one cubic centimeter of urine.				
	XVIII.	XIX.	XX.	XXI.	XXII.
1.	1.11	1.05	1.00	0 95	0 91
2.	2.22	2.10	2.00	1.90	1.82
3.	3 33	3.16	2.00	2.86	2.73
4.	4.44	4.14	4.00	3.81	3.64
5.	5.55	5.26	5.00	4.76	4.54
6.	6.67	6.31	6.00	5.71	5.45
7.	7.78	7.37	7 00	6.67	6.36
8.	8.89	8.42	8.00	7.62	7.27
9.	10.00	9.47	9.00	8.57	8.18
10.	11.11	10.53	10 00	9.52	9 08
11.	12.22	11 58	11.00	10 48	10 00
12.	13.33	12.62	12.00	11.43	10.91
13.	14.44	13.68	13.00	11.38	11.82
14.	15 55	14.74	14 00	13.33	12.73
15.	16.66	15.79	15 00	14.28	13 64
16.	17.78	16.84	16 00	15.24	14.57
17.	18.89	17.89	17 00	16.19	15.45
18.	20 00	18.95	18 00	17.04	16.36
19.	21.11	20.00	19 00	18 09	17.27
20	22 22	21 05	20 00	19 05	18 18

Increase of the earthy phosphates is a characteristic of brain and nerve waste; it is also noticed in phthisis, rachitis and other wasting diseases. A temporary phosphuria may result from indigestion, or irritative affections of the bladder.

5. In 1823, the Faculty of Medicine of Heidelberg offered a prize for the best solution of the following problem: Determine what are the substances which, introduced into the organism of man or animals, by mouth or in any other way, pass out in the urine, and indicate what may be inferred from such knowledge. It was Wöhler who obtained the prize. Wöhler operated on dogs which took, while fasting, in their messes the various substances experimented with, and then by frightening them, he made them urinate. Since then the process has been improved by catheterizing the dogs, and Gérard has even proposed to utilize for this study birds, and

has given a very ingenious process by which the latter may be made available for these studies.(*b*)

6. Here are a few indications relative to the elimination of certain substances by the kidneys:

Sulphate of Quinine.—The greater part of the sulphate of quinine ingested (fully one-half at least) is eliminated by the kidney. Its presence is noted in the urine thirty or forty minutes after its ingestion (Gubler). Its elimination lasts from two to five days.

Bromide of Potassium.—Bromide of potassium passes out in the urine, and every trace of this medicament disappears in from fifteen days to a fortnight after the administration of the remedy.

Iodide of Potassium also passes out in the urine, and takes from three to eight days for its elimination.

Mercury takes a long time in being eliminated by the kidneys.

Salicylic Acid is eliminated as salicyluric acid. Begins to be eliminated twenty five minutes after its ingestion, and lasts forty-five hours for a dose of thirty grains.

Ferro-cyanide of Potassium.—Some say it is eliminated rapidly, others tardily in the urine.

Chlorate of Potassium is eliminated unchanged in the urine; according to some authorities, in its totality.

Salts of Lithia are eliminated in very feeble quantity in the urine

Chloral.—Not eliminated as chloral in the urine, but formic acid and uro-chloralic acid have been found (Musculus, Hering) which result from the decomposition of chloral; these acids reduce the cupro-alkaline liquids.

Chloroform —Uncertain whether or no chloroform is eliminated by the urine. Some affirm it, others deny. Drumeau says it is eliminated unchanged by the lungs, and not at all by the kidneys.

Carbolic Acid passes out in the urine, giving a quite special black coloration to this fluid. It is the same with resorcin. Fuchsine gives a red color, picric acid a yellowish color to the urine, which are all characteristic.

Salts of Lead are eliminated by the urine, though slowly; their presence in the urine is difficult to detect by chemical reagents.

(*b*) Wöhler, Recherches sur le passage des substances médicamenteuses dans les urines (Zeitschrift für Physiologie, t. Ier, 1824), et traduction (Journal des progrès des sciences, t. Ier, p. 45, 1827).– Gérard, De la durée de l'élimination des médicaments par les urines.

7. According to Gubler, senna and rhubarb give to urine a special coloration, making it resemble jaundiced urine; liquor potassæ, however, added to it brings out a characteristic purple color. This reaction is due to the chrysophanic acid in the rhubarb and senna. This purple color is still more conspicuous when ammonia is used instead of potash.

8. These are Beauvais' conclusions:

1. Failure in the elimination of medicinal substances by the urine is an exclusive pathognomonic sign of Bright's disease;

2. This sign gives due value and importance to the symptom albuminuria, and indicates the degree and nature of the corresponding anatomical lesion;

3. In absence of albuminuria the capital symptom, or of the characteristic dropsy, the absolute, incurable suppression of the passage of odors in the urine, imposes at once the diagnosis, prognosis and treatment.

However, this sign has not, according to Chauve, the value which Beauvais attributes to it. Save in cases where the complete structural alteration of the kidneys absolutely prevents the passage of odorous substances, there are very many instances where the impermeability is not complete and the elimination of odorous substances is permitted, despite enough renal degeneration to cause uræmic symptoms. Strauss has observed cases of this kind.

9. The modifications which characterize the elimination of medicines in renal diseases have been known for a long time. Hahn, Rayer, Corlieu, have reported cases of impermeability of the kidney to odors (turpentine, asparagus) in albuminuria; and Beauvais, who had witnessed like facts, has even drawn the conclusion that the failure to eliminate substances by the urine is an exclusive. pathognomonic sign of Bright's disease, and may be indicative of the degree and nature of the anatomical lesion. He goes even farther, and says that in the absence of albuminuria, the capital symptom, or of the characteristic dropsy, the absolute and incurable suppression of the passage of odors in the urine forces upon us at once the diagnosis, prognosis and the treatment. English and French physicians have reported observations which show the intolerance of opium in certain forms of Bright's disease. Todd, Dickenson, Cornil, and Charcot have related facts that are quite convincing.

But it is Bouchard especially who has called attention to

the danger which may follow the administration of active drugs where renal lesions exist.

In 1873, he published two observations of mercurial poisoning, resulting in death to two patients, the one suffering from interstitial nephritis, the other from parenchymatous nephritis, and who had taken but small doses of this medicament.

From such facts and others like them, Bouchard has drawn the conclusion that "diseases of the kidney render toxic, active medicines administered even in small doses." This conclusion seems, moreover, to be in accord with physiological experiments.

Claude Bernard, in fact, has shown that in a curarized animal if a double nephrectomy be performed, the elimination of poison no longer taking place the animal succumbs rapidly, even though artificial respiration be kept up.

Chauvet, a pupil of Bouchard, has gathered together these facts, and has undertaken researches concerning the elimination of certain medicinal substances by the kidneys; he has arrived at the same conclusions as the physician of Bicêtre.

Chauvet studied quinia sulphate, potassium bromide, iodide of potassium, mercury, salicylic acid, and reports a very interesting observation, especially from a medico-legal point of view, published by Dr. W. W. Keen, of Philadelphia.

It relates to a man of between forty-five and fifty years of age to whom a prostitute had given opium in order to put him to sleep, and then to rob him. Falling rapidly into a comatose state, the man died 24 hours after, and the autopsy showed the existence of chronic interstitial nephritis at an advanced stage.

Chauvet has remarked that sulphate of quinine is eliminated much more slowly by diseased than by healthy kidneys, and in cases where he has been able to compute the amount of the alkaloid recovered each day of the elimination, he has always noted a quantity quite inferior to the normal.

As to bromide and iodide of potassium, the elimination is also longer and more difficult. As for mercury, he recalls two of Bouchard's observations, and shows the disastrous effects of even small doses of this drug. In eight patients treated by salicylic acid, the elimination was very much prolonged; moreover, in two there was a very manifest weakness and languor, and in one who took only four grammes of salicylate of sodium, the toxic phenomena were a long time in disappearing.

CHAPTER II.

DIURETICS.

SUMMARY.—Diuretic Medicaments—Classification of Diuretics—The Kidney as a Dialyzing Organ—Tensor Diuretics—Cardiac Diuretics—Vascular Diuretics—Mixed Diuretics—Water as a Diuretic—Dialyzing Diuretics—Advantages and Evils of Irritant Diuretics—Anuric Medicaments—Dry Diet—Sudorifics—Opium—Valerian—Water Charged with Oxygen.

Diuretics constitute a very important group in therapeutics. The number of these substances is large, and systematic writers have endeavored to arrange them in distinct classes, taking for the basis of their division the therapeutical action of these medicaments. I intend in my turn to give you the classification that seems to me most logical.*

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* Forbes Roylle proposes the following classification of diuretics:

1. Medicines acting primarily on the stomach and digestive system, and secondarily on the urinary organs.

2. Medicines which act primarily on the absorbents, and secondarily on the kidneys.

3. Medicines which act primarily on the urinary organs.

4. Stimulant diuretics.

Wood's division is as follows:

1. Hydrogogue diuretics (squills, digitalis, broom-top, etc.)

2. Refrigerant diuretics, constituted by the entire series of neutral salts.

Of all the theories proposed to explain urination, that of Küss and Wittisch best accommodates itself to a physiological division of diuretics. In the foregoing chapter, I showed you that these physiologists hold that Bowman's capsule filters not only urine, but also

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3. Stimulant diuretics, such as buchu, pareira brava, uva-ursi, juniper, the balsams, cantharides.

Fonssagrives gives the following classification:

1. Aqueous diuretics (water and milk).

2. Stimulant diuretics (tea, coffee, alcohol, essences, and balsams).

3. Acid diuretics.

4. Saline diuretics (acetate and nitrate of potash, and neutral salts).

5. Drastic diuretics.

6. Specific diuretics (digitalis, squills, cantharides, urea, jaborandi).

Gubler arranges diuretics into three classes:

1. Such as irritate the renal parenchyma, like nitrate of potash and urea, which deserve a place among the most useful of this class.

2. Tensor diuretics, *i. e.*, such as modify the circulation by increasing the active and not the passive tension, the latter being unfavorable to diuresis.

3. Diuretics which excite the nerves of the kidney and provoke it to action; their action is similar to that of sialagogues.

These diuretics are then stimulants of the nervous system of the kidney.

Prof. Sée divides diuretics into two groups: 1. Medicines that augment the energy of the heart and blood-vessels and thus raise the blood-pressure in the kidneys (digitalis); 2. Medicines which act by dialysis (nitrate of potash, etc.).

albumen, and in such a manner that the kidney may be considered not merely as a filter, or even as a selecting filter, but as a real dialyzing organ, since we may regard Bowman's membrane as a dialyzing membrane, having above and below it an albuminous liquid.

Laure, of Lyons, ranges diuretics in the following order:

1. Vaso-motor diuretics, such as digitalis, squills, bromide of potassium, ergot, tannin and plants which contain it.

2. Aqueous diuretics; plain water, mineral water, milk.

3. Neutral salts: nitrates of potassa and soda, and plants which contain them; chlorates of potassa and soda, etc.

4. The cyanides (cyanide of potassium, cherry laurel water, spiraea ulmaria, etc.)

5. Acid diuretics (sulphuric, nitric, and citric lemonades, vinegar and water, etc.).

6. Balsamics, such as copaiba, cubebs, turpentine, benzoic acid and plants containing it.

7. Certain excitants, which are capable, nevertheless, of retarding the movement of denutrition, such as alcohol, the effervescent wines, beer, koumys, tea and coffee.

8. Jaborandi.

9. Peroxide of nitrogen under the form of oxyazotic water.

These are the conclusions at which this writer has arrived:

1. The diuretic medication, one of the most precious resources of therapeutics, responds to the following indications:

a. To maintain the action of the kidney.

b. To evacuate effused liquids.

c. To allay irritation of the genito-urinary organs.

d. To modify the urinary excretion by opposing the ex-

The kidney, then, as a dialyzing organ, must come under all the laws which Graham has indicated, and which govern the phenomena of dialysis.

You all know in what dialysis consists, and what curious results have been obtained by these new

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cessive production of uric acid and of phosphates, and thus to prevent the formation of gravel and calculi.

e. To establish a derivation by the renal emunctory.

f. To aid the elimination of toxic principles peculiar to or foreign to the organism.

2. It is difficult to demonstrate that certain diuretics act either by virtue of their dialytic power, or by their influence on the blood pressure.

3. If, however, this influence does exist, everything leads to the belief that the diuretics owe more especially their properties to an elective and thus far inexplicable action on the secreting elements of the kidney.

4. Apart from water, squills, digitalis, ergot, a great number of diuretics are unreliable in their action, and most owe in large part their virtues to the water which is their vehicle.

5. Under the influence of alterations of the kidney which ordinarily retard elimination, digitalis becomes rapidly toxic, even in feeble doses. This is why this medicine ought to be given with great reserve in dropsies of renal origin.*

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* Darroze, Thèse de Paris, 1871. Verdun, A Study of Diuresis and Diuretics. Thèse de Paris, 1872. Wood, Therapeutics and Materia Medica, Philadelphia, 1874. Fonssagrivès, Treatise on Applied Therapeutics, Montpellier, 1878. Gubler, Soc. de Thérapeutique, 1878. G. Sée, An Attempt at a Physiological Classification of Medicines (Bull. de Thérap., 1878, txciv). Laure, On Diuretics (Thèse de Agrégation, 1878, Paris).

methods of research. You are acquainted with the phenomenon of the passage through an animal or vegetable membrane placed between two liquids of different composition, of the elements of one of the liquids towards the other. Now examine what takes place in the glomerule of Malpighi and in the upper portion of Henle's tubes, which before joining the straight tubes, inosculate around the glomerule. You see a membrane, Bowman's capsule, which separates two liquids; the one contained in the capillary plexus of the glomerulus, is the blood charged with excrementitious products; the other, in the tube of Henle, is the albuminous serum of the blood. It is through this membrane, between these two liquids of different composition, that constant exchanges take place, enabling the components of the urine to pass into the extremities of the renal tube which conducts them out of the organism.

This comparison of the kidney with a dialyzing apparatus we may pursue farther, and show that the laws which govern dialysis govern also the functions of urination. What, in fact, do these labors teach us? This, namely, that we may influence dialysis, either by augmenting the pressure of one of the liquids, or by modifying, either the liquid itself, or the dialyzing membrane.*

* When two liquids of different chemical composition are separated only by a membrane, or even by a septum of baked clay or very thin plates of slate, the phenomenon of

Now, in applying these three conditions to the study of medicaments designed to augment urination, we shall see that such medicines can be ranged in the four following classes:

In the *first class* are placed medicaments which modify the blood pressure, either by energizing the cardiac systole, or by acting on the muscular element of the circulatory system.

To this first group are assigned all the diuretics

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osmosis is produced *i. e.* there is reciprocal transmission of the two liquids through the diaphragm which separates them. It was on this principle that Dubrunfaut founded his process of purification of saccharine liquids, and in 1854 he made a communication to the Academy of Sciences upon this method of analysis by osmosis.

Graham, who has given great study to this question, applies to this method the name of *dialysis*. Dialysis consists, in fact, in the separation of substances in solution by diffusion through a septum or diaphragm of colloid matter.

The instrument which serves for these experiments, and to which the discoverer has given the name *dialyzer*, is only a modified endosmometer.

Graham prefers as a dialytic membrane, vegetable parchment or parchment paper, which is prepared by soaking papier Joseph a few seconds in sulphuric acid or in a solution of the chloride of zinc, and then washing it in water.

This paper is applied wet to a rim of thin wood or gutta percha, 5 c.m. deep and 20 or 25 c.m in diameter, so as to form a sort of sieve; the edges of the disc of paper, whose diameter must be greater than that of the circular rim, are covered over the latter and fixed by a stout string.

In order to prevent the diaphragm from being porous, you

already studied under the name of heart tonics, which, while augmenting the contractile power of the cardiac muscle, increase the urinary functions. Gubler gave to this group the name of *tensor-diuretics*. It includes two varieties of medicaments, one variety, as digitalis, convallaria, caffeine, act directly on the car-

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cover it with a layer of albuminous liquid, which is then coagulated by heat.

The liquids with which you are to operate are poured into this species of sieve, so as to form, as far as possible, a layer of only 12 millimeters in thickness.

The dialyzer is finally made to float in a large vessel containing water enough so that the diffusion may go on through the parchment paper. At the end of 24 to 48 hours the crystalloids are completely separated from the other matters with which they were blended.

Experimenting upon urine, Graham has seen a pint of urine submitted for 24 hours to the process of dialysis, abandon all its crystalloids to the water outside, and he has seen this latter when evaporated by a sea-bath, deposit a white saline mass from which urea could be extracted by alcohol in such a state of purity, that crystalline tufts were obtained by evaporating this alcohol.

Graham designates under the name of crystalloids those substances which dialyze, *i. e.*, have a strong property of diffusion; others, such as dextrine, starch, gums, caramel, albumen, tannin, and in general, all bodies of gelatinous consistency, and destitute of the property of crystallisation, have a very feeble power of diffusion, and have received the name *colloids*. But notice that, if these last substances are incapable of diffusion they allow themselves to be easily traversed by water and crystalloids.

diac fibre; others, as strychnine, ergot of rye, etc., have a special elective action upon the muscular coat of the arterial system.

There has been much discussion respecting the value of these tensor diuretics; some have denied them the property of raising arterial tension, others have insisted upon this property. These contradictions, gentlemen, depend on the fact that the different experimenters did not put themselves in the same conditions of experimentation. In fact, in the physiological state, the diuretics of this group have little or no influence; let a healthy man take digitalis, it will diminish considerably the number of his cardiac pulsations, but it will augment very feebly the quantity of his urine. But, on the contrary, where there is anuria resulting from a mitral affection, you will see produced under the influence of diuretics, an excessive diuresis; the patient will pass quarts of urine, and all the serosity accumulated in the cellular tissue and in the serous cavities will flow off by the kidneys.

In the *second* or *mixed class* you will range the medicaments which produce diuresis by augmenting the pressure and modifying the liquids.

This is the case with water, which Bouchardat regards as the best diuretic. Water introduced into the economy in great quantity augments the mass of the blood and hence the blood-pressure, while at the same time modifying its composition.

Certainly, the greater part of the ptisans called

diuretic, and most of the mineral waters regarded as such, act more by the quantity of water than by the saline substances which they contain.*

We may affirm that this second class of diuretics is the only class of medicaments which are truly diuretic in the physiological state. Water taken in great abundance augments the quantity of urine, and in pathological states we always see polydypsia and polyuria go together. So, while the medicines of the first group render as great service whenever in passive congestions of the kidney we wish to restore the flow of

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* If nearly all the diuretic plants act principally through the water which serves as the vehicle of their administration (infusions, decoctions, ptisans), some of them, however, owe their action in all probability to the principles which they contain, such as salts, essential oils, resins. The following are examples:

PARIETARIA OFFICINALIS.—Has sulphur and nitre. The infusion is the preferable form; 10 grammes of the leaves to a quart of water.

JUNIPERUS COMMUNIS.—Essential oil, salts of lime and potassium. Off prep.—Infusion, oil, tincture.

SAMBUCUS NIGER.—Salts of potassa and lime, resin, and volatile oil. An infusion of the inner bark, ʒ ss to the Oii. (Aquæ Sambuci, U. S. P.)

LAPPA MINOR.—(Burdock). Nitrate of potash. A decoction of the root or of the seeds; (two ounces of the bruised root boiled down in Oiii of water to Oii and strained; dose, Oj, in divided doses during the day).

ARBUTUS UVA URSI.—Arbutin, gallic acid, resin. Off. prep.—Decoction, fluid extract, infusion,

urine, the diuretics of the second group ought to be employed when we desire to flush out the kidney and energize its functions, or, still further, when we wish to favor the elimination of toxic substances accumulated in the economy.

In the previous lecture, I showed you that the renal emunctory, from the point of view of the action of medicines, is the most active channel of elimination. I may supplement this statement by saying that it is also by this channel that man in the physiological and pathological state eliminates not only leucomaïnes

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Fœniculum (Fennel) —Essential oil; decoction: one ounce of the seeds to a quart of water.

Apium Graveolens (Celery). — Nitrate of potash, mannite, etc. Infusion. one ounce to the quart.

Asparagus Officinalis (Asparagus) —Acetate of potash, phosphate of lime, mannite, asparagine. Decoction of the root, ʒ ss dose.

Scoparius (Broomtop) —Scoparin and spartein, the one diuretic, the other narcotic. Off. prep.—Decoction and succus.

Iris fœtidissima (stinking orris).—Volatile oil and resinous matter. Infusion in two or three drachm doses.

Centauria Calcitrapa.—Acetate of potash, chlorides and sulphates of potash, lime; the powdered leaves are given in white wine.

Triticum Repens (dog grass).—Gum, triticine, silicate of potash, etc. A strong decoction is used.

Scilla Maritima (Squills).—Scillitin, resin, citrate, tartrate and phosphates of lime. Off. prep.—Acetum scillæ; pil. ipecac cum scilla; pilulæ scillæ co.; syrup. scillæ; tinctura scillæ.

and ptomaïnes, which, as we have seen, are constantly formed in the economy, but also the micro-organisms that develop there, and Bouchard under the names of infectious nephritis and microbic nephritis, has particularly insisted on these points. You understand the interest that there is, in connection with all these infectious diseases, in favoring this elimination, and this indication is fully met by diuretics of this

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Stigmata of Maize (Corn Silk).—A new diuretic that has come much into use. Has mannite. Infusion and fluid extract.

Spiræa Ulmaria (Queen of the Meadow).—Tannin, essential oil. Given in infusion or decoction of leaves, stem or root.

Petroselinum (parsley).—Volatile oil, apiol, essential oil. Diuretic in strong infusion.

Cerisier (Cerasus Caproniana).—The stones of the cherries are used; these contain tannin. Given in decoction.

Borrago Officinalis (Borage).—Nitrate and acetate of potassium, salts of lime. An infusion of the leaves and flowers is given for diuretic effect.

Gaultheria Procumbens.—Essential oil. Is given in infusion.

Pyrola Umbellata.—Resin, tannin, gallic acid, essential oil. Off. prep.—Decoctum chimaphilæ.

Pareira brava.—Resin and nitrate of potassium. The decoction is principally used for diuretic purposes.

The alkaline mineral waters are all more or less diuretic, both from their water and their alkaline ingredients, *e. g.*, Contrexville, Vittel, Evian, Vichy, Pougues, in Europe, Poland, Saratoga, Lisbon, Clysmic, Bethesda, Buffalo-lithia, etc., in United States.

second class, and in particular by milk, that admirable medicament, which, while nourishing the patient, promotes in a marked degree the functions of urination.

To the third class belong the medicaments described under the name of dialyzers. They produce their action by modifying the blood, and by introducing into it saline elements. Thus, nitrate of potassium, nitrate of sodium, acetate of sodium and potassium, act as diuretics, and because certain plants, as Chatin has shown, contain these different salts (parietary, for instance), they have been found to have marked effects on the renal functions.*

The dialyzing medicines which constitute this group have over the preceding a real disadvantage, in that by their presence they irritate the renal paren-

* The researches of Chatin have shown that the presence of nitrates in plants is a general fact, but variable according to soil, kind of leaves, kind of species.

Besides the pastel (Isatis tinctora), the stinking goose foot (Chenopodium vulvaria) the borage, the nettles, the beet, parietary, etc., Chatin has observed that all the plants which belong directly, or by near relationship, to the category of mural plants are rich in nitrates. Plants growing on rocky soil, especially those of the porous limestone rocks, abound in nitrates, like mural plants. Other species, such as grow in meadows (ulmaria), shady places, (belladonna), and fields (fumetary knot grass), are rich in nitrates like those of the walls and rocks. Corn, oats, barley, rye, are poor in nitrates. It is not so however with buckwheat and maize.

Among the most nitriferous families, we find the Cheno-

chyma, and often provoke too much irritation in the digestive tube. This it is that happens whenever the dose of nitre is carried too far. So, for my part, I make but little use of these diuretics, much preferring those of the preceding group.

The fourth class includes those medicaments which have the property of modifying the dialyzing membrane. These are substances which actively congest the kidney. Thus it is that resins and balsams enter into the class of diuretics, but the disadvantages which I mentioned in connection with the preceding group are here still more pronounced; the urine is increased, to be sure, but it is also profoundly modified. Hence the balsams and resins render us greater service in diseases of the urinary passages by lessening the effects of putridity of the urine, than by any real diuretic action.

Such, rapidly summarized, is the classification

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podiaceæ, Amarantaceæ, Caryophyllaceæ, Polygonaceæ, Solanaceæ, Papaveraceæ, Fumariaceæ.

The dioctyledons contain generally more nitriferous plants than the monocotyledons, and among the acotyledons, the mosses hold the chief place, the lichens, mushrooms and algæ the last.

Among cultivated plants, such as exhaust the soil (as the gramineæ), are altogether poorer in nitrates than those that improve the soil, such as the leguminosæ.

The nitrates accumulate in the woody parts, sometimes also in the roots; they are least abundant about the time of maturation of the fruits.

which seems to me the best of the great group of diuretic medicines.

Alongside of diuretics, we should place, by way of contrast, the *anuretic* medicaments, for if in certain cases (ordinarily the most numerous) the chief indication to fulfil is to augment the quantity of urine, there are other cases, on the contrary, where it is the opposite indication which should be met, as in that badly defined disease which is described under the name of *diabetes insipidus* or simple *polyuria*.

Unfortunately here we lack very precise indications, and it is by a rather tortuous way that we attain our end. Thus, it is by reducing the amount of liquids ingested that we may to a considerable extent diminish the quantity of urine secreted, and by promoting the functions of the skin and favoring profuse sweats, we also diminish the sum total of the urine. Thus, pilocarpine in subcutaneous injections, and certain phenols such as antipyrine, may lessen the amount of urine by quite a considerable degree. Lastly, certain substances, such as opium, and especially morphine, by acting on the capillaries of the kidney, diminish diuresis in notable proportions.

Finally, there is a group of medicinal substances of which the anuretic action is quite manifest, such as tincture of valerian, vaunted by Trousseau in polyuria. Water charged with oxygen (oxygenated water), Ozanan says, produces the same effect, without our being able to understand the intimate cause

of this action, and it would be of interest to arrange in a line parallel with the different groups of diuretics, a like group of medicinal substances called *anuretics*, and I call your attention to this interesting subject.

Such are the brief considerations which I wished to present to you relative to the subject of diuretic medicaments, and I will enter at once upon the main part of my subject by setting forth the treatment of urinary lithiasis. This shall be the subject of my next lecture.

CHAPTER III.

TREATMENT OF URINARY LITHIASIS.

SUMMARY:—Urinary Lithiasis—Acid Lithiasis—Alkaline Lithiasis—Uric Gravel—Its Characters—Oxalic Gravel—Phosphatic Gravel—Treatment of Urinary Lithiasis—Etiology of Uric Gravel—Uric Diathesis—Alimentary Causes—Pathogeny of Uric Gravel—Therapeutic Indications—Alkalies, Indications and Doses—Choice of Alkalies—Salts of Potassa—of Lithia—of Soda—Hygienic Treatment—Influence of Diet—Treatment of Oxalic Gravel—Causes of Oxalic Gravel—Therapeutic Indications—Ammoniacal Gravel, Causes, Therapeutic Indications.

GENTLEMEN:—Urinary lithiasis is a common disorder which you will often be called upon to treat. I intend to give particular attention to this subject, from the fact that we may, in the great majority of cases, by an appropriate hygienic and medicinal treatment, cause this lithiasis to disappear. I shall divide my lecture into two parts: In the first I shall take up the treatment of the lithiasis itself, and in the second, that of the accidents of which it may be the cause.

In considering the treatmeut of urinary lithiasis, I shall confine myself to the subject of what is called *supra vesical lithiasis*; in a word, I shall not touch upon stone in the bladder, an affection which claims a surgical treatment quite outside of the plan of these lectures. It should be understood, also, that under

the name *lithiasis*, I do not comprehend the solid deposits of the urine, and what Bouchardat calls *urine dust*. These deposits of solid particles and this "urine dust" are only produced after cooling of the urine, while, on the contrary, in urinary lithiasis, the solid particles are formed in some part of the urinary passages before the urine is voided.

You know that authorities have divided lithiasis into different groups, according to the size of the solid particles contained in the urine, and that they have described as sand, gravel, and calculi, deposits whose component parts are of varying dimensions. This classification presents little interest from a therapeutic point of view; it is not so, however, with the division which is based on the nature of the lithiasis. You will see, in fact, that the cure of the affection depends on the exact knowledge of the nature of the calculi, and in the adaptation of a special treatment to each of those varieties. So, whenever a patient comes under your care for renal lithiasis, you ought, first of all, to ascertain the chemical nature of this lithiasis, and to attain this end, you will have recourse to chemical tests and to microscopic examinations; these tests are very simple, and the microscopic examination easy.

The history of urinary concretions goes back to the most remote antiquity, but among the ancients stone in the bladder was much better known than renal lithiasis.

Hippocrates speaks of the action of calcareous waters, and of stagnation of the urine as causes of gravel.

Galen carefully describes renal lithiasis; he speaks of nephritic colic, and counsels two kinds of treatment; abundant ingestion of water for lithiasis, and blood lettings for nephritic colic.

Aretæus, who also gives a complete description of lithiasis, insists that if medicines may have a solvent action on the small concretions, they remain without any effect on vesical calculi of considerable volume.

Sydenham, Baglivi, Morgagni, Hoffmann, Boerhaave and Van Swieten describe urinary lithiasis and vaunt the utility of alkalies.

In 1776 began the chemical studies on lithiasis. Scheele discovered lithic (uric) acid in calculi. Bergmann found phosphate of lime. Wollaston completed these researches by finding cystic-oxide, and the ammoniaco-magnesian-phosphate. Marcet discovered calculi of xanthine. Lastly, in 1819, Brugnatelli summed up all these facts in a remarkable treatise.

The modern epoch begins with the labors of Proust, Magendie, and the remarkable treatises of Civiale in 1838, and of Rayer in 1841.

When we take a general view of the nature of calculi, we see that some of them form in acid urine, others in alkaline; hence the names acid lithiasis and alkaline lithiasis. In both cases, the lithiasis may be constituted by products found normally in the urine, or by substances introduced there accidentally, or which have developed pathologically; hence the subdivision of lithiasis into normal and abnormal.

In acid urine, we have as normal lithiasis, uric gravel, and as abnormal lithiasis, oxalic gravel. In alkaline urine, we find as normal lithiasis, calcareous gravel, and as abnormal, ammoniacal gravel.

Let us then begin the study of urine containing calculi by testing the reaction of this liquid, and by the sole fact of the latter being alkaline or acid, we shall be able to make a first distinction.

Is the urine acid? You will have to examine if it be a case of uric or oxalic gravel, and here the microscope and the chemical reactions will enable you easily to arrive at the diagnosis.

Uric gravel, which is much the most common kind, is constituted by a reddish brick-dust sediment, such as you will often find in the urine of individuals who have passed their fortieth year, and which is very often seen in the urine of the arthritic. Examine this brick-dust precipitate under the microscope, and it will appear to you under the form of crystals resembling a whet-stone, of a characteristic reddish-yellow or orange tint.

In other cases, the forms are more variable, and you have before you odd crystals, lance-shaped or in the form of rosettes, daggers, halberts, canine teeth, nails or spines. The figures which I here present (Figs. 1 and 2) give you a very clear and characteristic representation of these crystals. As for their chemical reaction, it suffices to touch these calculi with a little nitric acid and to add a drop of ammonia, and you obtain a magnificent purple color from formation of murexide.*

*Uric acid $C_2H_4N_4O_3$ is like urea an azotized substance; it exists in urine chiefly in the state of an alkaline urate, and is

Quite different is oxalic gravel, which presents itself under the form of fine sand, of a bluish gray,

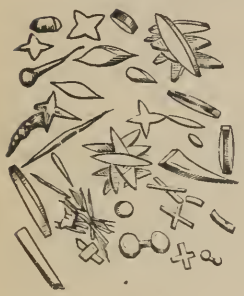

FIG. 1.

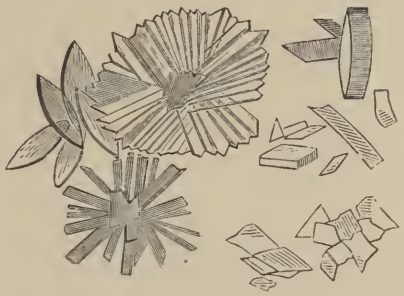

FIG. 2.

and not red color. If you examine this sand under the microscope, it is no longer the appearance of a whet-stone or lozenge, but that of a star, or rather of

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deposited when the urine is cold, under the form of crystals of a reddish, yellow or bright red color. These crystals resemble rectangular prisms, lozenges, whet stones, etc., sometimes several crystals are grouped together and form stars or rosettes. Uric acid is feebly acid; it does not redden litmus; insoluble in alcohol and ether. In fact, in order to dissolve one part of uric acid, you need 15,000 parts of cold water, and 18,000 of boiling water; it dissolves wholly without decomposition in concentrated sulphuric acid. It is precipitated from its solutions by acetate of lead. Heated in a test tube, it gives rise to urea, cyanuric acid, hydrocyanic acid, carbonate of ammonia, and alloxan. Treated by concentrated nitric acid, uric acid breaks up into urea and alloxan. The latter, under the influence of a few drops of ammonia, or even of ammo-

a closed envelope, which is presented by these crystals of oxalate of lime which constitute oxalic gravel, and it suffices to compare the following figure (Fig. 3) with the foregoing figures to see clearly the difference which from a micrographic point of view separates oxalic from uric gravel.

Here you no longer get the violet coloration by nitric acid and ammonia, but if you add sulphuric acid and raise the temperature, gases will be liberated, con-

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niacal vapors, turns to a reddish purple color (purpurate of ammonia), which by the addition of caustic potash, becomes bluish purple.

The murexide observed by Scheele, studied and designated by Proust under the name of purpurate of ammonia, crystallizes in quadrangular prisms, or in tables which are green by reflected, and red by transmitted light. These crystals, which contain a molecule of water, give those magnificient metallic reflections which the wings of cantharides display; they dissolve in water with a rich purple color.

The following table giving the results of analysis of 1,000 cases of urinary lithiasis, shows the relative frequency of each kind:

Uric acids or urates	372
Phosphatic gravel	263
Lithiasis of a complex nature	233
Oxalate of lime	232
Total	1000

A propos of the age of calculous patients, statistics have been established bearing upon the frequency and nature of these affections at different periods of life.

As for the relative frequency, these are the results of a study by Civiale of 5,376 cases:

sisting of carbonic acid and carbonic oxide. So much for the acid urines.

Does the urine present an alkaline reaction? The sediment is almost always ammoniacal, and constituted by calculi of ammoniaco-magnesian phosphate, presenting themselves to the microscope under their characteristic coffin-shaped crystals (Fig. 4). You will also sometimes find a calcareous lithiasis in alka-

FIG. 3.

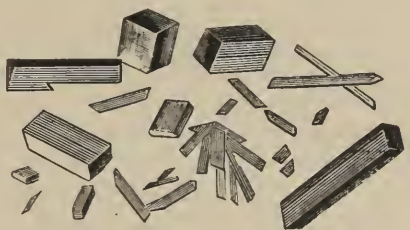

FIG. 4.

From 1 to 10 years of age	1946
From 10 to 20 years of age	964
From 20 to 30 years of age	460
From 30 to 40 years of age	340
From 40 to 50 years of age	391
From 50 to 60 years of age	513
From 60 to 70 years of age	577
From 70 to 80 years of age	199
Above 80 years of age	17

As for the nature of the calculi, the following variations have been noted according to the age of the subjects:

1. In infancy and adolescence, there is predominance

line urines formed by amorphous strata of tribasic phosphate or carbonate of lime.

The ammoniaco-magnesian phosphates ($2MgO, NH_4 PO_5 + 12H^2O$) crystallize in voluminous prisms with rhomboidal base, when you examine them after their natural deposition in ammoniacal urine. In acid urine and in fresh urine, the phosphates do not form a precipitate; to obtain such precipitate in fresh urine you have to add several drops of ammonia; in these cases the crystals no longer present themselves under the form of rhomboidal prisms, but they take on the aspect of needles, stars, and arborizations.

The ammoniaco-magnesian phosphate is insoluble in water and ammonia; it is precipitated from its solutions by the alkalies and ammonia; it is soluble in acetic acid and in the mineral acids.

Lastly, to complete the subject, I may tell that you there exists an indifferent lithiasis characterized by calculi of an extreme rarity and which I will only mention, namely, cystic gravel constituted by cystine, and xanthic gravel.

Cystine ($C^3H^5 N So^2$) is found in urine ordinarily in the state of a sediment mingled with urate of soda, or under the form of a calculus. It was discovered by Wollaston in 1805.

The crystals of cystine appear in the form of six-sided lamellæ. Deposits of cystine are insoluble in the warm urine, or in warm water; they are dissolved by ammonia, and if the

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of oxalate of lime calculi, sometimes associated with the carbonate.

2. In adult age, calculi of uric acid and urates predominate.

3. In old age we oftener observe calculi formed of the earthy phosphates and carbonates.

ammoniacal solution be allowed to evaporate, the six-sided crystals are again deposited. To differentiate them from uric acid, treat them with some mineral acid, which dissolves cystine, while leaving uric acid crystals intact. Treated by HCl, zinc or tin, cystine gives off sulphuretted hydrogen.

Xanthine ($C^5H^4N^4O^2$), discovered by Proust, is a rare form of urinary calculus. When dry, it forms an amorphous, yellowish white powder, very sparingly soluble in cold water, rather more freely in hot water. If dissolved in nitric acid, and the solution evaporated by heat, xanthine leaves a yellow residue which assumes a reddish yellow color on contact with potassium hydrate solution, and this, when heated, turns violet red.

When you have ascertained the nature of the lithiasis, you can institute a treatment which shall, on the one hand, be directed to the cause, and on the other, to the removal of the gravel; and you will see that, according to the kind of deposit, the management of the case will be different. Let us, then, examine successively from this point of view, uric gravel, then oxalic and phosphatic gravel.

Three great causes: diathetic, dietetic and renal, favor the formation of uric gravel.

1. The uric diathesis, what Bouchardat calls the *polyuric* diathesis, is a frequent affection which often serves as a basis for the development of gout; and if there may be uric gravel without gout, it is impossible to have the latter without uric gravel; we see even the children of gouty patients subjects of this gravel, which is also a morbid complication in most arthritic complaints.

2. The alimentary causes of uric lithiasis have been long known. Results of the incomplete combustion of azotized matters, uric acid shows itself whenever the diet is too rich in albuminoid matters, or to be more precise, whenever the diet is not proportioned to the work and to the combustions of the economy; in a word, uric lithiasis is the gravel of the rich man and the citizen. Already in my lectures on regimen* I have shown you the evils of a diet too largely azotized, and among these evils I have given the first place to the uric diathesis.†

3. As for the local diseases of the kidney, they may, by a mechanism which I shall soon explain, become the point of departure of gravel.

When we come to study the intimate mechanism of the three causes above given, we find difficulties of a serious nature, and I ought here to enter into certain explanations.

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*Diseases of the Stomach and Intestines. Part 1. (Am. Ed.)

†The causes of the uric diathesis are the following: An excessive nitrogenized diet, and the abuse of fatty food and of sweets; 2, the prolonged use of alcohol, and of certain wines, in particular of the effervescent wines, as well as of strong beer; 3, a sedentary life and insufficient exercise, overwork of mind, mental emotions and grief; 4, the suppression or the diminution of the cutaneous functions; 5, dyspepsia, which may result from the uric diathesis, but which also may augment the production of uric acid; and accord ng to Lasègue, it is almost always in a trouble of the digestive functions that

It was once thought that in order for uric acid gravel to be brought about, it was necessary simply that the uric acid should be in greater quantity than it ought to be in the blood, as this increase would manifest itself by an augmentation of the uric acid in the urine; at the same time, if in the immense majority of cases we note this increase of uric acid in the blood of calculous patients, the fact is far from being a constant one, and Garrod and Beale have reported observations in which there was rather diminution than increase in the quantity of uric acid in the circulation.

Hence physiological chemists have alleged another reason, and have said that it was sufficient that the blood should contain certain substances which opposed the solution of uric acid, to see the latter pass immediately into the urine, although there might not

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we find the cause of the superabundance of uric acid in the economy; 6, heredity.

Bouchardat has established a division of urinary lithiasis according to the social position of individuals who are affected thereby.

1. In the peasant, you frequently observe calculi of oxalate of lime.

2. In the rich inhabitants of cities, given to good cheer and to idleness, calculi of uric acid predominate.

3. In rich or poor people who make an abuse of venereal pleasures, you are very likely to find calculi of earthy phosphates, and this results from the frequency of affections of the urinary passages in these patients.

be any increase in uric production. This chemical explanation has been chiefly supported by Voit, who was the first to point out the fact that uric acid, being little or not at all soluble in a solution of acid phosphates, when the latter are in excess in the blood, they determine the appearance of this kind of gravel. Alcohol acts in the same way, uric acid not being soluble in alcoholic solutions. We might demand if we may not find in this very fact an explanation of the uric diathesis, and of the gout which is met with in certain kinds of poisoning, in lead poisoning for instance. These are very important facts, which I pray you to keep in mind; they even go to show that when we have to do with the dietary of persons who are the subjects of gravel. we should proscribe alcohol and too acid fruits.

This chemical explanation of uric gravel is not the only one which has been given; authorities have also spoken of certain functional troubles on the part of the kidney. They have pretended that when the urine contains less than the normal quantity of water, it thereby presents a favorable condition for the uric diathesis. It has also been affirmed that certain functional disturbances taking place—according to the prevailing theories of urination, whether in the Malpighian glomerules, or in the tubuli contorti, have for their consequence a more free elimination of uric acid. Lastly, the presence of mucus in the urine, in determining the production by fermentation of lactic acid,

augments the acidity of the urine, and in this way favors the precipitation of uric acid.

To sum up, from a therapeutic point of view, we have in uric gravel two great indications to fulfill; that of diminishing the acidity of the urine, and of augmenting the quantity of water therewith excreted.

To diminish the acidity of the urine, we should employ alkalies, and this method, which has been in use, empirically, since the 15th century, is the only one which can give good results, and if writers have disputed the value of the alkaline treatment of lithiasis, it is because they have forgotten the important point to discriminate the kind of gravel which they had to treat. Heroic and curative medicaments in the treatment of uric gravel, alkalies have deplorable effects when administered for alkaline gravel and this is why some of the old authorities maintained that in certain cases the alkaline treatment is more injurious than useful in lithiasis.*

What alkalies should you choose? What doses should you give, and how should they be administered? These are important points to discuss, and thanks to

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* It was Basile Valentin, a chemist of the 15th century who first prescribed the alkaline carbonates. One of the most vaunted remedies for urinary concretions was that of Lady Stephens. The British Parliament, in 1739, bought this prescription for a large sum of money. The Academy of Sciences in France published a report on this remedy, and Morand, referee, showed that it was composed of egg shells, of soap,

the experiments of Roberts, we are able to respond categorically to each of these questions. Roberts submitted calculi of uric acid to the action of alkaline solutions more or less concentrated, and ascertained by weighing, the quantity of the calculus dissolved in a given time. He demonstrated this capital fact, that a calculus of uric acid does not dissolve in an alkaline menstruum in the ratio of the strength of the latter. When the alkaline medium contains too large a proportion of the alkali, it has no solvent action on the uric acid. There forms, in fact, under these circumstances around the calculus a layer of biurate of sodium which prevents the solvent action of the alkali; while, on the contrary, when the alkaline solution is weak, the calculus dissolves with greater activity. These are facts of the utmost importance, showing that it is in moderate and rather feeble doses that you should administer the alkalies. Roberts made also a curious experiment from which we can draw a lesson; he placed a quantity of uric acid of a given weight in an alkaline solution of definite strength, and then reckoned what the

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of burned snails, of a decoction of chamomile flowers, of fennel, and of parsley. At the same epoch, the medical profession was making earnest trials with alkalies, and in particular with carbonate of soda, in the treatment of stone, and the Vichy waters began to have a considerable reputation in calculous affections. But it was not till after the labors of Magendie, and the report of Charles Petit to the Academy of Sciences in 1829, that the question really became scientifically settled.

uric acid had lost in weight without any movement being imparted to the mixture; then, with a solution of the same strength and volume which he took care to let fall by constant dropping upon the uric acid, he ascertained the solvent action of this new solution, which proved to be very much greater than in the previous instance (when the calculus was acted upon in a still liquid), and when the flow was so slow that the alkaline solution fell drop by drop upon the gravel, the solvent action attained its maximum of intensity.*

What are we to conclude from these facts? We have a right to infer that, in order to obtain the solution of uric gravel, we should both dilute well our doses and give them at short intervals, so that the urine shall be constantly impregnated with these alkaline principles, and thus maintain a continuous solvent action on the calculus.

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* Roberts observed on immersing calculi of uric acid in solutions of potassa, that 12 grammes of potassium carbonate in a pint of water are without effect upon the calculi, and it is the same with eight grammes.

Six grammes per pint dissolve three per cent. of a calculus per day; three grammes dissolve 20 per cent.; 1.50 grammes 11.9 per cent.; 0.50 gr. 6.05 per cent., etc.

Roberts, in another series of experiments, noted that in 24 hours 1.50 gr. of carbonate of potash dissolved in a pint of water had upon a calculus of uric acid the following action: 45 pints without flow dissolve 13 per cent. of the calculus; 8 pints with continuous flow, 10 per cent; four pints with continuous flow, 9 per cent.; two pints flowing drop by drop, dissolved 17 per cent. of the calculus.

You understand, of course, that I am speaking only of the possibility of the solution of uric gravel; when the stone is formed in the bladder, the result is much more doubtful, and notwithstanding the curious facts signalized by Debout, and still more recently by Constantin Paul, of the spontaneous fragmentation of stones in the bladder, I believe we cannot count on lithontriptic medication (if there be any such) to attain this end.

What is the alkali to which we should give our preference? In England practitioners administer potassa and lithia; in France, we prefer soda. We will consider these in their order. In England they give the citrate, acetate, and carbonate of potassa; the English physicians affirm that uric acid is more soluble in potassa than in soda, and Roberts counsels the *liquor potassæ* of the English pharmacopœia, and especially the citrate of potassa, in the dose of 12 to 16 grammes per day, taken in divided doses every three hours.*

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*Citric acid is tribasic, its formula being $C^{12}H^{5}O^{11}3KO$. it is made (U. S. and B. P.) by saturating potassium bicarbonate with citric acid. The dose is from 20 to 25 grains. The Liquor Pot. Cit. is officinal; dose ʒss to ʒij.

Potassæ acetas (acetate of potassa) is made by saturating bicarbonate of potassa with acetic acid. It is a white salt, neutral to test paper, of warm pungent saline taste. Has been called *foleated earth of tartar.* It is very soluble in water, and is deliquescent. It is diuretic in the dose of a scruple

If you adopt the English treatment, I advise you to employ the following potion:

Citrate of potash, 12 to 15 grammes.
Infusion of arenaria rubra, 90 grammes.
Syrup of 5 roots, 30 grammes.

[May be replaced in American practice by the following:

℞ Pot. citratis, ʒ ss.
Syr. scillæ, ʒ i.
Infus. scoparii, ʒ v.

M. Sig.—A tablespoonful three or four times a day.]

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to a drachm; in the dose of ʒ ij to ʒ iij it is purgative. For a diuretic effect, it should be largely diluted.

Potassæ carbonas (carbonate of potassa) is obtained from crude pearlash by purification, or from cream of tartar by incineration. It is a coarse, granular, white powder, with nauseous, caustic, alkaline taste, very soluble in water, insoluble in alcohol. The dose is from 10 to 30 grains largely diluted.

Liquor Potassæ.—(For mode of preparation, see U. S. P.) The dose is from 10 to 30 minims very largely diluted in sweetened water or some mucilaginous fluid (infus. aurantii cort. is a good menstruum).

Lithia is a white crystalline substance of caustic taste. (For mode of preparation of lithia and its carbonate, see U. S. P.) The carbonate is the salt generally employed. It is a light, white powder, which is but little soluble in water. It may be associated with carbonate or citrate of potassa. The dose of carbonate of lithia is 3 to 6 grains, which may be taken in carbonic acid water. The *citrate of lithia* is an eligible salt, which is less disagreeable than the carbonate; the dose is from 5 to 10 grains.

For my part I am not very partial to potassa as a medicament for habitual use. The salts of potash are very active, and I have already told you, when speaking of purgatives, the great difference which exists between the potassium and the sodium salts in the r effects on the economy. This difference exists throughout the entire series of the potassium salts as compared with those of sodium, the first having a manifest depressant effect on the economy. Bouchard has long insisted on the toxicity of potash, which he says is 60 times greater than that of soda; as this toxic action manifests itself in cases of renal insufficiency, you understand the dangers which may attend the use of the potassium salts in the treatment of urinary lithiasis. Hence, I much prefer lithia to potassa, and were it not for the high price of this base, it would be likely in my judgment to supersede the other alkalies in the treatment of uric lithiasis.

Lithia is given in the form of carbonate or citrate, in doses of from 3–5 grains three times a day. I think that you should not exceed the latter dose, and I cannot endorse Charcot's method, who gives as much as 30 grains of lithia in the 24 hours; given in such doses, the lithia salts are sure in a little while to bring on fatigue of the stomach and digestive troubles.

The carbonate of lithia has this important peculiarity, that it is soluble only in carbonic acid solutions. Hence, in administering it, you will have to stir your dose of lithium carbonate into a little artificial soda or

Seltzer water, or some one of the natural gaseous waters. A good way is to give your lithia salt in a glass of water along with the ordinary effervescent powders of sodic bicarb. and tartaric acid; in this way you give your patient a combination of lithia and soda. You can also make use of the granular effervescent salts of carbonate or citrate of lithia, or the syrup of lithia made according to Duquesnel's formula.

Soda, if it does not possess all the energetic effects of lithia, presents nevertheless an advantage that it is of moderate price. We generally order either the bicarbonate of soda in substance, or the sodic-bicarbonate waters. An excellent method is the administration of effervescent powders, of which one contains one drachm of bicarbonate of sodium, the other a scruple of tartaric acid.

The bicarbonate of soda is given in solution in the dose of two to three grammes a day, but the usage of the natural alkaline waters is much to be preferred. Choose especially (and here you can fall back on the experiments of Roberts as the basis of your treatment) mineral waters containing a feeble quantity of sodium bicarbonate, 2 to 3 grammes to the litre, and among the Vals waters prescribe, Saint Jean, and among the Vichy waters the springs of Hauterive, of Celestins, and of Saint-Yorre. To these spas, you may join Boulon, Velleron and Chaudes-Aigues, in France, Ems in Germany, and Bilin in Bohemia.

Bouchardat recommends that these waters shall

be taken with light white wines, sometimes slightly acid, such as are obtained from the centre of France. These light wines, when diluted with the alkaline water, constitute a very agreeable beverage, presenting this great advantage, that the combination of the two forms a real tartrate of potash and of soda, which has a favorable action from the point of view of the solution and expulsion of the uric gravel.

Has this alkaline treatment, to which we give the first place in the therapeutics of uric gravel, any evils as well as advantages ?

It has been asserted that the prolonged usage of alkaline waters has an injurious action on the blood, and particularly on the red blood corpuscles, and that anæmia is the inevitable consequence of this kind of treatment. Trousseau is mainly responsible for having created in its entirety the alkaline cachexia, which he believed to be the result of the *deglobulizing action of alkalies*. Since Trousseau's time, the experimental method has been perfected, and we may to-day affirm that alkalies are rather medicaments favoring and regulating nutrition than enfeebling to the organism.

Coignard had already shown us that alkalies augment and improve the combustions of the economy, but it is chiefly to the remarkable experiments of Hyades and Martin Damourette that we owe the scientific demonstration of the favorable action of these medicaments on nutrition. Lastly, the researches of Pupier and Lalaubie, who have always noticed

under the influence of alkaline waters an augumentation of the globular richness in the anæmic, show us that there is little foundation for this bugbear of the alkaline cachexia, which is based rather on theoretical and preconceived notions, than on clinical and experimental facts rigorously observed.

Trousseau described an alkaline cachexia similar to what is observed after the long administration of iodine and the mercurials. It is, he said, characterized by emaciation, pallor, a general bloated appearance, passive hæmorrhages and serous effusions. This cachexia was based on the deglobulizing influence of the alkalies. According to Gubler, this baneful action is due to the fact that while the salts of soda abound in the serum, salts of potash predominate in the corpuscles; if you augment in too great quantity this soda in the serum, the globules lose their potassa, and in consequence their hæmatic properties. Climent had even found by Malassez's system of enumeration, a notable diminution of the globules under the influence of alkalies, and Rabuteau had maintained that the alkalies notably diminish the figure of urea-production.

All these facts have been taken up anew, and it appears to be demonstrated that if, as Lomikowsky has done, we may determine in dogs, like those to which he administered daily and for a long time half an ounce to two ounces of bicarbonate of soda, accidents of a grave kind, and in particular very intense digestive troubles, in man, on the contrary, you always augment the figure of urea as well as that of the globules, and the experiments of Mialhe, of Coignard, and others mentioned above, seem in this respect to be absolutely demonstrative. Alkalies, then, act in therapeutic doses as excitants and regulators of nutrition, whether through their influence on the nervous system, or some unknown cause.

While recognizing the fact that the alkaline ca-

chexia is largely a myth, it must be admitted, nevertheless, that when abuse is made of the alkaline waters, and in particular of the alkaline salts, there may supervene a notable fatigue of the stomach, and in this respect there is a very marked advantage in the use of the natural over the artificial mineral waters. The first are tolerated, even in large doses, without provoking any digestive troubles, the alkaline solutions are, however, as I have just told you, painful and fatiguing to the stomach.

The facts whibh I have just stated also show you that it is a mistake to suppose that the alkalies act chiefly by neutralizing uric acid. Their favorable action in the treatment of uric lithiasis has quite a different origin. Alkalies act, as Basham and Harley and other authorities above mentioned have shown, by energizing the phenomena of oxidation of the economy, and thence aiding the transformation of uric acid into urea.

To the sodii-bicarbonate waters, you may add certain waters of the Pyrenees, as Laprest, Molitg, Olette, and especially Capvern, which have a real action in the treatment of uric gravel.

You have fulfilled the first indication by alkalies, *i. e.*, you have done what you can to oppose the excessive acidity of the urine, you must fulfill the second indication, namely, to hasten and favor the expulsion of the gravelly deposits. You will attain this end by employing the diuretics furnished by the mineral

waters, or by the pharmaceutical preparations. Here you will witness the triumphs of the waters of Pougues, Vittel, Evian, Contrexeville, and of all those waters of uncertain mineralization which do not contain any special principle which characterizes them, but which act chiefly by their mass. You may also recommend the silicious and lithiated waters, like those of Evaux, and Sail les Bains, which have a very energetic diuretic action.

To these mineral waters, you may add the action of certain medicaments. You may draw freely from the great group of diuretics spoken of in a previous lecture. The vegetable diuretics may here serve you a good purpose, and in particular the Arenaria rubra, the diuretic action of which has been lately so much extolled, or the Stigmata of maize, which has so recently come into vogue.

Arenaria rubra (red sandwort) is obtained from the shores of Algeria. The decoction (1 ounce to the Oij) is an excellent diuretic, and may be freely taken for this purpose.

Stigmata of maize (corn-silk) has lately come into use in this country, though long employed in Mexico. An ounce of the corn-silk to a pint of hot water makes a good infusion which may be freely drank. There is a fluid extract which is much in use; dose, a teaspoonful 3 or 4 times a day.

By the side of these alkaline and diuretic medicines, we must place a medicament whose action is quite different, and which has the property of transforming into hippuric acid and soluble hippurates the insoluble uric acid and urates; I allude to benzoic

acid, or rather the benzoate of soda, which is administered in the dose of 2 to 3 grammes a day, alone, or associated with acid phosphate of soda.

But these medicines must yield the palm to the hygienic treatment; this it is that dominates the therapeutics of uric lithiasis, because addressed to the very cause of the gravel. You should, then, bestow all your care in regulating the diet of your lithæmic patients, and the diet should be made to correspond to the exercise taken. Food too rich and too stimulating should be forbidden; the dark meats and especially game should be eschewed, and the alcohols should be proscribed; we have, in fact, seen that the latter leads to the precipitation of uric acid in the urine.

Make your patients adopt a mixed diet (*i. e.*, meat and vegetables in about equal quantities). Prescribe exercise which is such a powerful promotor of the interstitial combustions of azotized matters; require the patient to take long walks, practice gymnastics, and the more sedentary the life of your patient, the more active should be these forced exercises. Bouchardat has traced with the hand of a master the principal hygienic indications applicable to the uric diathesis, and I cannot do better than refer you to what he has said under this head.

Under the head of diet, Bouchardat advises to eat moderately; cut the food finely with the knife; masticate thoroughly.

Abstain from sorrel and tomatoes, from asparagus,

and green beans, if their usage causes renal pain or slight deposits in the urine.

Meats of all kinds agree, but they should be used moderately. Be chary in the use of eggs, fish, cray fishes, shrimps, lobsters, shell fishes and old cheese; milk is often useful.

Almost all the vegetables of the season agree and should make part of the daily fare; spinach, lettuce, chiccory, artichokes, cucumbers. salsify, cardoons, celery, carrots, turnips, sweet potatoes. Potatoes are useful, and ought in part to take the place of bread. Radishes may be eaten freely; cabbages, cauliflowers, sour krout, mushrooms, truffles, chestnuts, pea-nuts, filberts, beans, peas, lentils with moderation. Cresses, greens and lettuce should be freely indulged. All the fruits, if the stomach bear them well; strawberries. raspberries, peaches, bananas, apples, grapes, currants, cherries, pears, prunes, plums, pumpkins, cucumbers are advantageous, and should be made a part of the daily fare. Olives, almonds and nuts of all kinds should be sparingly eaten. Chocolate may be allowed for a drink, and coffee, if it be found to be diuretic. Prohibit brandy, and all other spirituous liquors, as well as beer. The only alcoholic beverage allowed is a light red or white wine diluted with twice its volume of water. The effervescent wines are contra-indicated, as well as water highly charged with gas, like the seltzer.

Take on waking, on going to bed, and at meals, enough liquid of some kind, so as to pass about a quart and a third of urine in the 24 hours.

These aqueous drinks should be: pure water, Vals (St. Jean) water, decoctions of couch grass, cherry tops, ash leaves, linseed, etc., or better still, a quart of water in which is dissolved one or two teaspoonfuls of Rochelle salts.

Under the head of excretions, he urges the importance of regularly and completely emptying the bladder every six

hours at least. A good walk after each meal, and efforts at defecation will help the patient to accomplish free urination.

At least one full stool every day is necessary. If any laxative is needed, one or two teaspoonfuls of white mustard seed or flax seed along with the breakfast may answer the purpose. Or, if this fails, from a teaspoonful to a tablespoonful of Rochelle salts in a glass of lemonade may be taken the first thing in the morning.

Under the head of *exercise*, Bouchardat urges the importance of gymnastics and other physical exercise that shall call forth all the forces. All chilling of the body not followed by reaction is to be avoided. Any exercise (as of the arms) that augments pulmonary expansion is good. Parlor gymnasiums (apparatus provided with elastic cords) exercise well the thoracic muscles and expand the lungs. Dum bells will do, in default of anything better. Wood sawing and chopping are especially to be recommended, and whatever exercise the patient takes should be sufficiently vigorous to provoke sweating. Then the patient should have a good rub down, and change his clothes. Active exercise is the most efficacious prophylactic treatment.

Under the head of care of the skin, Bouchardat advises a sponge bath in the morning, followed by long and vigorous rubbing with a dry towel and the flesh brush; then massage with the hand well ointed with sweet oil. At the same time, large and deep inspirations should be taken. Every week from one to three hygienic baths: 3 ounces carbonate potassa, ½ drachm essence lavender, 1 drachm tincture of benzoin to the water of a bath. These baths should be followed by frictions and massage.

Sea or river baths, if indulged in, should be of short duration, and followed by rubbing and exercise.

There is another kind of abnormal acid gravel to which I must allude, namely oxalic gravel. This kind

of deposit is found only occasionally or accidentally in the urine, and this fact clearly separates it from the preceding. While we have seen that uric gravel is ordinarily the result of a disturbance in the nutritive processes, in oxalic gravel we can allege but one cause, the introduction by food of vegetable substances containing oxalic acid. In fact, this is the gravel of individuals badly fed, of the peasant, the poor man. Proust, Bird, Garrod, Furbringer, and more recently Ralfe, have contended that there is an oxalic diathesis, but I believe, with Lecorché, that this diathesis is far from being demonstrated, and till further enlightened on the subject, we are to consider oxalic gravel as a simple accident, and the experiments of Esbach are absolutely confirmatory of this view. The more probable view then is that oxalic acid is never found in the urine except when introduced by the food.*

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* Furbringer claims that oxalic acid is a constant product of the urine, and that its daily elimination does not exeeed 24 milligrammes. Bicarbonate of soda does not augment the production of oxalic acid, nor do febrile processes increase its elimination.

According to Ralfe,† the sources of oxalic acid in the blood and in the urine are the following:

1. Certain ingesta: rhubarb, sorrel, tomatoes, onions, turnips; contain it, and in some persons cause digestive troubles and temporary oxaluria.

2. Incomplete oxidation of saccharine or oleaginous

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† London Lancet, Jan. 12th, 1882.

The difference in the pathogeny of these kinds of gravel entails a great difference in the therapeutic indications. Here the first indication to fulfil is dietetic, namely, the suppression of aliments containing oxalic acid, and as it is in gooseberries, tomatoes, garden rhubarb, and especially sorrel, that we meet with this acid, you should proscribe these

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substances. Coming from these two sources, the oxaluria does not determine any disturbance in the general health.

3. Exaggeration of the interstitial nutritive processes under the influence of most febrile affections, pulmonary and cardiac affections with dyspnœa, disturbances of the hepatic functions, and an asthenic condition of the nervous system. This etiological variety is very frequent.

4 Mucus in the genito-urinary passages; such is probably the origin of the large crystals of oxalate of lime found so frequently in the urine in spermatorrhœa. It is possible that the deposits of oxalic acid which form in the urine of ataxic patients, especially at the epoch of the urinary crises, are due to a modification of the state of the mucosa, associated with troubles of the innervation.

5. Acidity of the urine.

Esbach has proved that a great number of aliments contain oxalic acid, and the list given below shows the quantity of this acid in divers articles of food.

SPICES AND CONDIMENTS.

Black tea	3.750
Cocoa	3.520
Chocolate	0.900
Coffee (artificial admixture of retail dealers)	0.127
Chiccory-coffee	0.795
Pepper	3.250

articles of food. Bouchardat recommends also to interdict the gaseous beverages, effervescent wines, sparkling beers, the natural and artificial gaseous waters, and counsels the use of a varied and restorative diet.

Moreover, be guided by the curious analyses of Esbach, who has examined the various articles of food and condiments to ascertain how much oxalic acid they contain. You will not be surprised to learn that tea,

2. FARINACEOUS SUBSTANCES.

White bread	0.312
Potatoes	0.046
Bread of good quality	0.047
Barley flour	0.039
Wheat bran	0.848

3. VEGETABLES.

Sorrel	3.630
Spinach	3.270
Garden rhubarb	2.466
White cabbage	0.003
Beets	0.300
Green beans	0.212
Tomatoes	0.053
Celery	01025

4. FRUITS.

Dried figs	0.270
Currants	0.137
Prunes	0.120
Raspberries	0.062
Oranges	0.030
Citrons	0.030
Cherries	0.025
Strawberries	0.012*

*Esbach on Oxaluria, (Bull de Thérap, 1883, t. CIV, p. 385.)

cocoa, chocolate, pepper, contain per kilogramme more oxalic acid than sorrel, namely from three to four grammes. But remember this important fact, that milk never determines the presence of oxalic acid in the urine, hence a milk diet is excellent for patients afflicted with oxaluria. Such are the principal indications pertaining to the hygienic treatment of oxalic gravel.

You ought also to endeavor to dissolve these calculi of oxalic acid, or to expel them, and here you will understand the importance of an exact knowledge of the kind of lithiasis you have to treat. In uric gravel the alkalies have the first place; in oxaluria their rôle is nil, and these medicaments are useless. In fact, as Roberts shows, oxalic acid and the oxalates are not attacked by alkalies, which can only act when there exist, as sometimes happens, mixed calculi, *i. e.* containing oxalate of lime and urates.

There remain the diuretics, and we have here medicines which are of considerable use in oxaluria, such as diuretic infusions and mineral waters. Golding Bird speaks favorably of vegetable infusions, such as compound infusion of gentian, balm tea acidulated with a few drops of aqua regia, etc. The mineral acids (nitric, nitro-hydrochloric acid, sulphuric acid, acid-phosphate of soda) have been advised by eminent authorities in oxalic gravel; perhaps this mode of treatment is more theoretical than practical. I pass now to the treatment of alkaline lithiasis.

There are two kinds of alkaline lithiasis, the calcareous and the ammoniacal. The calcareous lithiasis is chiefly characterized by the presence of the phosphates of lime in the urine, and writers have even spoken of a *phosphatic diabetes*, *i. e.*, an exaggerated production of these phosphates in the urine. You must remember, however, that these phosphatic salts when in excess in the urine are not deposited under the form of calculi, but are held in solution because of the temperature of the urine. When, after being voided, the urine cools, they are precipitated in the form of a whitish, lactescent deposit. If these phosphates ever constitute calculi, this is a very rare occurrence. The case is different with the ammoniacal salts, which not seldom cause urinary concretions. The ammoniaco-magnesian phosphates oftener constitute vesical than renal calculi. This lithiasis is due to fermentation of the urea, and its transformation into ammonium carbonate. Therapeutically, then, the first indication will be to oppose this fermentation, in whatever way it may have originated.

Ammoniacal fermentation of urine is due to one of three causes: retention of the urine, inflammation of the kidneys, ureters, and bladder, or to trophic disorders; but, as Pasteur has shown, all these causes come together under one head—the production of a special *torula*, which, acting as a true ferment, determines the transformation of urea into ammonium carbonate.

We are still ignorant as to the real causes of the production of this ferment, but we know that when the urine contains pus, mucus, or blood, or remains long in the bladder, this fermentation takes place. Moreover, repeated catheterizations, whether by getting up an inflammation, or by conveying germs, produce the same effect.

Nevertheless, this question of urinary fermentation in the bladder is very obscure, and for proof of this, I need only allude to the influence which trophic disturbances exercise upon this ammoniacal transformation. Take, for instance, two patients, both affected with paraplegia. Both have retention of urine, both have been sounded the same number of times, with the same instruments, and, nevertheless, one of them shall have ammoniacal transformation of the urine, while the other shall remain for months without any alteration of the urine taking place. The cause of this difference lies in the fact that in the first paralytic the disease is due to a profound lesion of the cord, while in the second, the paraplegic symptoms are the expression of a functional disorder of the nervous system, of the nature of hysteria, for instance.

Whatever may be the cause, the therapeutic indication in these cases is very simple, namely, to modify as far as possible the urine, so as to prevent the ammoniacal transformation. We accomplish this in two ways: by means of certain essences and resins which, when introduced into the system as medicines, pass

out by the urine and favorably modify its properties, and by certain antiseptic substances. We fulfill the first indication by the employment of plants containing essences, like buchu, boldo, and santal.

Buchu leaves are furnished by three species of *barosma* or *diosma*, growing at the Cape of Good Hope. These leaves contain (1), a volatile oil which when exposed to the cold furnishes a camphor very soluble in carbon-bisulphide; (2), a resin and a bitter extractive. The infusion is made by steeping one ounce of the leaves in a pint and a half of water down to a pint; dose, a wineglassful. The tincture is given in teaspoonful doses; the fluid extract in the dose of 10 to 30 drops.

There are three kinds of sandal wood in the market, the white, yellow and red. The white and red have little medicinal virtue. By distilling the yellow sandal wood (santalum citrinum), a volatile oil is obtained, the essence of sandal, which is administered in capsules in the dose of from 10 to 30 drops.*

The turpentines and resins have the same action, and I must especially call your attention to a remedy which has gained a world-wide reputation in the treatment of ammoniacal gravel, namely Harlem oil, which is obtained by the distillation of juniper. Juniper (juniperus communis), as you know, is an evergreen shrub which is a native of Europe, and grows in many parts of the United States. The fruit and tops are officinal. This shrub owes its medicinal virtues chiefly to a volatile oil which it contains. The dose of this oil is 2 to 5 drops. The officinal preparations are the

*For remarks on Boldo, see "Modern Treatment of Diseases of the Liver," of present series, page 131.

infusion and the oil. The peasantry in the south of France prepare from the wood of the trunk and branches a sort of tar which they call *oil of cade;* mixed with the essential oil of juniper, it constitutes Harlem oil.

In these cases of lithiasis I often prescribe a pill made by rubbing together Venice turpentine with the soft extract of cinchona. This pill weighs just two grains, and is composed of equal parts of the two ingredients. The dose is three pills after breakfast and dinner.

Within the past two years a new remedy has been introduced, which comes from Chili, and is called pichi (fabiania imbricata). This plant is said to have a special elective action in catarrhs of the urinary passages. In the United States a fluid extract is in use, which is a good preparation, and may be given in frequent doses of half a drachm.

There are certain substances of an antiseptic nature which may be used internally, such as the benzoate of soda, salicylic acid, and resorcin. The latter has been made a special study by me in this hospital, and my pupil Hippocrates Callias has made these clinical experiments the subject of his inaugural thesis.*

*Resorcin (C^6H^4 OH^2), a body similar to phenic acid, was discovered in 1880 by Hasiwetz and Barth. It was first obtained from certain resins such as asafœtida, galbanum, and ammoniacum. It has since been made in the

Lastly, in certain cases, you can act directly on the bladder by injecting liquids destined to prevent fermation—solutions of chloral, carbolic acid, and especially boracic acid.

In making these injections, you can employ a double or single catheter, and the ordinary pear-shaped rubber-ball injector. These injections should be tepid, and when there exists paresis of the bladder, it has been advised to give them warm—104° F. to 112° F.—with the intention by the heat of stimulating the contractions of the vesical mucous membrane. These little measures, which belong rather to surgery

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laboratory by synthesis. Resorcin is found in commerce under three forms:

1. Large garnet colored crystals, of strong phenic odor; this is the impure product of commerce.

2. Prismatic needles of rose color and almost odorless.

3. Chemically pure (obtained by Monnet's process) in very fine, sparkling-white needles); this is medicinal resorcin.

Omitting the physical properties, and considering resorcin therapeutically, we find it to be antifermentative, and antiseptic, caustic in concentrated solution, and hæmostatic; it coagulates albumen. It has also antithermic properties.

Taken internally in the dose of from 1 to 2 grammes, it is rapidly eliminated by the urine, in part unchanged, and in part under a form yet unknown. This urine becomes of a deep brown color on exposure to the air. Treated by perchloride of iron (when resorcin is present in sufficient quantity), you obtain with an abundant white precipitate, a deep violet coloration similar to that obtained with salicylic acid. Resorcin

than to medicine, are of considerable importance, for vesical catarrh and its consequences are extremely frequent in male patients when they have attained an advanced age.

But here the dominant indication will be to prevent the sojourn of the urine in the bladder. You ought then to insist on the patient urinating as often as possible, and if the bladder is too inactive, or the prostate too voluminous to enable the vesical muscle to empty the viscus completely, you should urge the necessity of the use night and morning of the soft rubber catheter, whereby all the urine shall be drawn off and not allowed to remain long enough in the

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is toxic in large doses like phenic acid; in the dose of 30 centigrammes per kilogramme of the weight of the body, it produces convulsions, which may be compared to electric shocks succeeding each other at short intervals. In the dose of one gramme per kilogramme, it is rapidly fatal, the animal dying in 30 seconds with convulsions.

Resorcin has been given internally in fever with antithermic intent, and recently Peradon has brought together a certain number of cases occuring in the service of Dr. Desnos. These observations tend to prove that if resorcin has no curative action in rheumatism, it notably brings down the temperature in typhus and typhoid fevers. The dose as an antithermic is 30 to 45 grains, this quantity to be administered in divided doses during the twenty-four hours. (Callias, On the Employment of Resorcin in Therapeutics, These de Paris, 1881,— Dujardin-Beaumetz and Callias, On Resorcin, and its Employment in Therapeutics, 1881, Peradon, On the Employment of Resorcin in Therapeutics, Thèse de Paris, 1882, etc., etc.

bladder to become decomposed and deposit strata of ammoniaco-magnesian phosphates.

If there are means which are useful in the treatment of ammoniacal lithiasis, there are also means that are dangerous. The prolonged use or abuse of alkalies, by augmenting the alkalinity of the urine, is sure to do harm. Hence you see the necessity of what I insisted upon at the beginning of this lecture, namely, the determination of the nature of the lithiasis which you have to treat, and while you have seen that alkalies are heroic and curative in uric lithiasis, they can to nothing but harm in the treatment of ammoniacal lithiasis.

Such are the principal therapeutic indications in lithiasis; it now remains to study the accidents which it may determine, and this brings me to the subject of the complications of lithiasis.

CHAPTER IV.

TREATMENT OF THE COMPLICATIONS OF LITHIASIS.

SUMMARY.—The Complications of Lithiasis—Nephritic Colic—Symptoms of Nephritic Colic—Pathogeny—Therapeutic Indications in Nephritic Colic—Hydrothermal Treatment—Renal Hemorrhages—Diagnosis of Hematuria—Treatment of Hematuria—Inflammations of the Ureters and Renal Pelvis—Pyelitis—Treatment of Pyelitis—Renal Calculi—Hydronephrosis—Calculous Anuria.

In the preceding lecture I have considered urinary lithiasis and its treatment; to-day I call your attention to the remedies which are employed against the complications which arise from the presence of the gravelly deposits.

Three orders of accidents may occur; first, the acute painful phenomena determined by the passage of the gravel down the ureters when these foreign bodies travel from the pelvis of the kidney to the bladder. You know that there has been given to this symptomatic aggregate the name of *nephritic colic*. Again, these calculi, by irritating either the pelvis of the kidney or the ureter, or even by sojourning in the bladder, may determine inflammation or hemorrhage.

Finally, in certain cases when the calculus has obliterated the ureter, it causes a distention of the pelvis which soon involves the kidney itself and trans-

forms it into a cystic pouch; this is hydronephrosis. Moreover, you easily understand that if by any unfavorable coincidence the other ureter should be obliterated, anuria and uræmic complications will arise, being the consequence of the sudden arrest of the renal functions.

Let us study these complications successively. Nephritic colic, much the most frequent complication, presents a very characteristic array of symptoms, which you will find described in your text books on Practice of Medicine. You will there see signalized that peculiar sharp pain, so intense at times that it causes the patients to make loud outcries and ask for death to put an end to their sufferings. This pain extends from the affected kidney to the inguinal region, and even to the testicles. It is a mobile pain, changing its place as the calculus travels downward, and suddenly ceasing when the foreign body, having cleared the vesical orifice of the ureter, falls into the bladder. As in hepatic colic, vomiting supervenes, with cold sweats, lipothymia, and sometimes even mortal syncope. In the midst of this general disorder and this incessant agitation the pulse remains calm, and is even sometimes slower than natural.

Nephritic colic does not always have a sudden onset; sometimes there are sensations of tingling and numbness in the region of the kidneys, lasting (it may be) for weeks before the onset of the nephritic colic.

In other cases, it is a malaise and a painful sensation at the epigastrium which precedes the painful symptoms; then appears the characteristic pain. This pain is piercing and is always on the affected side; it is increased by pressure and extends over the abdomen and down to the labium majus in women and to the testicle in men; there is also a numbness extending down the thigh.

The patients always experience rectal and vesical tenesmus, they have a strong desire for defecation, and make frequent attempts at micturition; the urine is red, thick, and flows drop by drop; it often contains mucus and blood.

Vomiting rarely is wanting, the skin is covered with a cold perspiration, the pulse becomes small, thready, finally the expression of the face changes and takes on the aspect characteristic of intestinal and hepatic colic (facies abdominalis).

The colic may last three or four hours, sometimes even forty-eight hours, with more or less violent paroxysms, then all these symptoms suddenly cease. The patient experiences a sensation of relief, and of prostration. The urine at this stage sometimes becomes abundant.

As for the offending body, the stone, it may remain in the bladder for several days, and even be the nucleus of a vesical calculus, but more frequently it passes out with the urine, and gives more or less pain in the canal of the urethra.

Such is the usual course of nephritic colic, the symptoms of which are sometimes confounded with those of hepatic colic, which are distinguished by the appearance of jaundice in the one case, and then, by the seat of the pain, which differs in both cases. As for the aggregate of symptoms, it is the same in both kinds of colic, and this you will readily understand if you recall to mind the origin of the attacks of pain.

When I was speaking to you of hepatic colic, I dwelt at length upon the structure of the bile ducts, in order to show you that the painful phenomena result from a muscular spasm caused by irritation of the mucous membrane, and that this spasm produces reflexly all the other symptoms noted in such cases. Here the pathogeny is the same; the ureters, like the bile-ducts, are lined by a highly sensitive mucous membrane, and have, moreover, an undoubted fibro-muscular tunic. When a foreign body traverses these ducts, it may determine there painful spasm, and various reflex symptoms due thereto.

It is an important fact to note, that it is not by its size that a calculus determines these accidents, but by its asperities. You may have a calculus of uric acid relatively voluminous, but round, smooth, and resembling shot, which may traverse the ureter without producing any symptoms whatever, while, on the other hand, another stone, like the oxalate of lime calculus, much smaller in size, but rough, and with sharp projections, may cause a most painful and distressing colic. All depends, as you see, on the irritation which the foreign body may set up in its passage through the ureter.

The identity between the pathogeny of hepatic colic and that of nephritic colic, entails an identity in in the treatment, and I need here only refer you to what I have already stated at some length in reference to the treatment of hepatic colic: to diminish the

painful spasm, to hasten the march of the calculus, are the two indications to fulfil.*

As for the first indication, you will meet it by having recourse to the three great medicines mentioned in connection with hepatic colic; opium, chloral and chloroform.

Do not forget that, as in hepatic colic, the most natural channel for the introduction of medicines is closed to us by the occurrence of vomiting, and that there remain only the skin, the rectum, and the pulmonary mucous membrane; here we witness the triumph of hypodermic injections of morphine, which have driven from the field the other preparations of opium, such as were proposed by Chomel, as well as the datura stramonium, counselled by Zaar, and the extract of belladonna, vaunted by Dubla.

Chomel prescribed every hour, or every half hour, a half grain of opium in solid or liquid form. The opium has also been given in lavements composed of two tablespoonsfuls of flax-seed tea, a teaspoonful of sweet almond oil, and a couple grains of extract of opium.

Zaar gave his stramonium with castor oil, while Dubla advised to rub well into the loins and abdomen, three times a day, an ointment composed of fifteen grains of extract of belladonna, with half an ounce of lard.

The hypodermic injections are to be administered in the same dose as in hepatic colic. The combina-

* See Modern Treatment of Diseases of the Liver (Library Series, 1888), Chapter III, p. 68.

tion of atropine ($\frac{1}{100}$ grain) with morphine ($\frac{1}{4}$ grain) is a good one; there are tablet triturates for sale in the United States which are convenient for this purpose. But it will not do to push the atropine too far; if your hypodermic has to be repeated, the morphine had better be used alone. Ten to fifteen drops of Magendie's solution (morphine sulph., gr. xvi, cherry-laural water ℥ j) may be used subcutaneously, and repeated as required.

You may as I have told you, utilize absorption by the rectum, and employ suppositories of opium and belladonna, and lavements of chloral, although this method is often rendered difficult or impracticable by the incessant efforts at defecation which accompany nephritic colic. Lastly, there remains the pulmonary method, employed for the first time in 1849 by Valleix, who chloroformed a patient suffering from a horrible nephritic colic, This is, I am bound to say, an excellent method, and just as in hepatic colic, you should have recourse to it when the pain becomes insupportable, but it is unnecessary to obtain surgical anæsthesia, but simply obstetrical anæsthesia. This employment of chloroform by inhalations is much superior to other methods of using this anæsthetic which have been proposed in such cases, whether by mouth or by external applications.*

*Aubrun has suggested the following method, viz., the application over the renal region and other painful points of the abdomen, of a compress saturated with chloroform, this compress to be covered with a watch glass.

I have given you the most efficacious, and I may say the only efficacious means to diminish the intensity of the painful spasm in nephritic colic. Other therapeutic agents have been proposed, which are addressed rather to the second indication which we have to fulfil, *i. e.*, to hasten the passage of the calculus. Some have suggested mechanical means, and have thought that various inclined positions might help the progress of the foreign body. Roberts held his patients up by the heels; others give patients snuff to make them sneeze or endeavor to provoke fits of coughing.

These manœuvers should be all abandoned, and I may say the same of certain reflex phenomena which some have sought to bring about in the ureters, by applying blisters and sinapisms to different parts of the body, or even by the use of hydrotherapy. I believe that these therapeutic means are inapplicable to nephritic colic. Finally, turpentine and coffee have been advised; Richter has advocated the former and Schapmann the latter remedy. But these means are directed more toward the urinary lithiasis than to the nephritic colic.

The only means of hastening the progress of the calculus is by the use of diuretics, which by producing an abundant flow of urine, force onward the calculus and hasten its passage; here, as you know, we witness the triumph of certain mineral waters of uncertain mineralization, such as Vittĕl and Contrexéville. And

just as we have seen persons affected with hepatic colic have recourse to the therapeutic action of the waters of Vichy and Carlsbad, so also almost all patients suffering from renal gravel may use to advantage the diuretic waters of Contrexéville, Vittél, Evian, etc. Often, even, the action of these waters reproduces attacks of colic, and we have here a point of resemblance with the effects of alkaline waters on biliary calculi. Such, in brief, is the treatment of nephritic colic.

Renal hemorrhages are often, as I have said, the consequence of the presence of urinary calculi, whether seated in the pelvis, whether passing down the ureter, or whether sojourning in the bladder.

You readily understand that by their presence, or their rough points, they may wound the mucous membrane and lacerate blood vessels which shall thus give rise to a more or less abundant hæmaturia.

But before treating these hæmaturias, it is well to verify the presence of blood in the urine. For this there are two processes; the one which is the most certain consists in the microscop cal examination of the urine, which reveals the presence in greater or less number of blood globules; the other is a chemical process advocated by Almen, which is based on the blue color assumed by tincture of guaiacum in presence of bloody urine.

In a test tube you pour a little tincture of guaiacum mixed with an equal quantity of turpentine, then you add some urine,

agitating it with the mixture. If the urine contains blood there will be produced a more or less intense blue color; if there be no blood, the precipitate is white or greenish.

When once the diagnosis is established, it remains to ascertain the source of the blood. In the case of females, the mistake may be committed of confounding menstrual blood, accidently commingled with the urine at the monthly period, with blood coming from some part of the urinary tract. This mistake may be easily avoided. Then you should ascertain at what moment of micturition blood appears in the urine. If at the beginning of micturition, the urine which flows subsequently being colorless, it is probably from the urethra that the blood comes. If the blood appears at the end of micturition, it is more likely, in fact almost certain, that it proceeds from the bladder, having accumulated at the base of that viscus. Lastly, are the blood and urine intimately mixed? The presumption is that the hemorrhage has taken place at the source of the urinary excretion, and that the seat is in the kidney, though it may be in the ureter.

After having determined the presence of blood in the urine and the seat of the hemorrhage, there remains a third diagnostic point to settle, namely, the cause of the hemorrhage. You know, in fact, that calculi are not the only sources of bloody urine, and that this affection may be an essential and sporadic disease, like the hæmaturia of the Antilles, whether such disease be linked to fevers of hemorrhagic form

(hemorrhagic small-pox, hemorrhagic scarlet fever), or whether dependent on a local disease, as inflammation or cancer of the kidney.

The treatment of hæmaturia, like that of hemorrhage in general, comprehends two great indications: 1, the treatment of the cause; 2, the treatment of the symptom. We have seen how variable the cause is, and I cannot without exceeding the limits of this lecture take up each of these causes separately and specify the treatment proper for it.*

I shall then take up here only the treatment of symptoms, and in particular those of calculous hæmaturia. After having prescribed rest in bed and a recumbent posture, as well as demulcent and acidulated drinks, means which alone may bring about a cessation of the bloody discharges when these are slight,

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* Spring divides the *hæmaturias* as follows:

1. *Essential hæmaturia*, in which he places the hæmaturia endemic in Mauritius, and that which is witnessed in Egypt, Brazil, and at the Cape of Good Hope, Cape Natal and in the East Indies.

This hæmaturia, called the hæmaturia of *warm countries*, is of a parasitic nature. Indeed, Bilharz, in 1851, found in the hæmaturia of Egypt a special distoma; in 1866 Otto Wucherer, of Bahia, found the ova of an unknown nematoid; in 1870 Cobbold, in a case of hæmaturia at Port Natal, met with the ova of Bilharz's nematoid; in 1872, Lewis, of Calcutta, discovered the presence of the embryos of the filaria of Wucherer; in 1874 Prospero Souzino found this same filaria in the Egyptian hæmaturia. However, despite all these researches, some au-

you may add, if the hemorrhage persists, astringents such as rhatany, tannin and especially ergot and preparations derived from ergot, as ergotine and ergotinine. The two latter medicaments may be advantageously used in subcutaneous injections; it is one of the most efficacious means of combating visceral hemorrhages.† You may also use to advantage the oil of sandal wood, or the oil of erigeron Canadense, giving from 10 to 20 drops of either of these essential oils in

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thorities, and Gues in particular, deny the parasitic nature of this hæmaturia of *warm countries*.

We should also place among the essential hæmaturias that form which Wickham Legg has described under the name of *paroxysmal hæmaturia*.

2. The *organopathic hæmaturias*. According to Spring, such are those which result from alterations in the kidney, and here belong traumatic and calculous hæmaturia.

3. *Dyshæmic hæmaturia*, which has been observed in certain diseases, such as scarlatina, variola, scorbutus, hæmophilia.

4. *Toxic hæmaturia*, hæmaturia due to the introduction of certain medicinal or toxic substances into the economy. To this group belongs the hæmaturia caused by the sulphate of quinine, and which has recently been described by Dr. Karamitsas, of Athens.

Vulpian has also seen hæmaturia caused by intra-venous injections of chloral.

5. *Supplementary hæmaturia*, which is seen after the suppression of an habitual flux.

†See Diseases of the Heart (Library Series, 1887,) p. 127-128 (Chapter on Passive Congestions of the Viscera).

capsules. Such is the treatment of calculous hæmaturia.

Like renal hemorrhage, renal inflammation, or inflammation of some portion of the mucous membrane of the urinary passages, is often the consequence of the irritation of calculi. There is no more frequent cause of pyelitis, which passes rapidly to suppuration; this is a disease which is often rebellious to all our therapeutic agencies. This suppurative pyelitis may subsequently extend through the ureter to the bladder. On the other hand, there is often a propagation upwards of inflammatory affections of the urethra, the neck of the bladder, the prostate gland, to the ureter and thence to the kidney, and not only does this inflammation attack the mucous membrane of the pelvis of the kidney, but it soon attains the renal parenchyma itself, and this is one of the most grave complications of phlegmasia of the urinary passages.

These inflammations manifest themselves by the following symptoms: First, pain in the region of the kidney, especially on the affected side; this pain is increased by pressure, or by movements, and in particular those connected with walking and the jolts of a carriage. To these local troubles, are joined certain general symptoms characterized by fever of remittent or intermittent form, symptoms which are always present if suppuration is abundant. In the urine you will meet with the products of this inflammation, *i. e.*, more or less pus and blood; the pus, which is often so inti-

mately mixed with the urine that the urine is clear on being voided, is deposited at the bottom of the vessel when the urine is allowed to stand a few hours, appearing in the form of a creamy precipitate, which under the microscope is seen to consist of pus corpuscles, and if agitated in a test tube with liquor potassæ, forms a dense gelatinous or mucous mass which adheres firmly to the sides of the test tube. On decanting some urine from the deposited pus, the presence of albumen can be detected by heat and nitric acid.

In cases of this kind, the part of the physician consists in modifying the urine as speedily as possible, as well as the inflamed mucosa; and here we witness the triumph of certain balsams and antiseptics. You may employ in turn turpentine, tar, benzoate of soda, etc. One of the best preparations is a combination of oil of turpentine and the soft extract of cinchona, as in the following formula:

℞ Venice turpentine,
Soft ext. cinchona, ää gr. ij.

M. For one pill.

From three to six of these pills may be taken after breakfast and dinner.

You should above all insist on a milk diet, which gives excellent results in these cases, not only as a diuretic, but as a modifier of the digestive functions.*

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*See Diseases of the Stomach and Intestines, (Wm. Wood & Co.) page 121, 138.

I shall not say much about the surgical interference proposed in these cases. Moved by the duration of these calculous nephrites, and the little success attending the medical treatment, certain surgeons have proposed for these states two sorts of operations; the one consists in ablation of the diseased kidney; this is the *nephrectomy* which Prof. Leon Le Fort was the first to perform in France; the other has for its end to open the pelvis, and by removing the stone, to rid the organism of the cause of the morbid accidents; this is the nephrotomy which Rayer advised as early as 1846. Others have gone so far as to propose direct crushing of the stone in the kidney, and this is what our colleague Le Dentu did very successfully in one case.

I can only indicate to you these operations, but as the successful cases are becoming more and more numerous, we must to-day regard this surgical interrerence as useful in a certain number of cases.* The

* Medical literature has been enriched recently by a great number of observations of nephrectomy, both in France and in foreign lands. To the recent facts given by Le Dentu, who has practiced nephrectomy several times, and that of Pean, who, in a case of cancer, completely extirpated the kidney, we should add the observations of Rosenbach in Germany, and of Thornton, Thornburn, Palmer, in England, and of Vecchi and Wright in America.

Rosenbach compiled sixty cases of extirpation of the kidney of which twenty eight were followed by death. Here is a resumé of these different operations:

part of the surgeon has not consisted solely in penetratign the kidney to crush and extract calculi which have accumulated in the pelvis, but it has had for its end to remove this organ, whether in consequence of cancerous degeneration, or prolonged suppuration, or of simple ectopia; in the latter case, by a radical operation the patient is rid of the persistent pains which always accompany displacement of the kidney. But if surgical interference (at least till further advances have been made) is to be counselled only as an extreme and desperate measure when it is a matter of ablation or incision of the kidney for calculous nephritis, you should have recourse to it, on the contrary, when it is a case of propagation of the inflam-

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Twenty-nine times the operation was performed through the abdominal wall, and sixteen of these operations were fatal; thirty-six times it was performed by means of a lumbar incision and twelve were fatal.

Seventeen times the operation was done for suppuration of the kidney or pelvis, with or without calculi, and seven of the cases died.

Thirty times for tumors, and nine died.

Nine times for hydronephrosis or cysts, and three died.

Nine times for floating kidney, and two died.

Five times for calculi and painful non-suppurating kidney, and two died.

Five times for fistula of the ureter, and two died.

Five times for adhesions with tumors, and two died.

Twice for recent traumatism, and two got well.

Once for tuberculosis, and one died.

mation to the renal capsule, *i. e.*, when you have to do with peri-nephritic abscess.

These abscesses arise spontaneously, or they may be the consequence of renal sand. They manifest themselves by a train of symptoms that are characteristic, and in particular by the appearance of a fluctuating tumor in the region of the kidney, and the usual constitutional disturbances which accompany extensive suppurations. Here surgical interference is necessary, and the free incision of these suppurating tumors to enable antiseptic washings to be performed, is the only curative treatment, and if I do not dwell longer on this point, it is because these operations belong rather to surgery than to medicine.

Finally, there is another kind of tumor which may accompany urinary calculus, namely, hydronephrosis, that is to say, the cystic transformation of the kidney under the influence of the arrest of the urinary excretion. In this case, the urine first distends the ureters, then the pelvis, then this distention affects the renal elements themselves, and there results a more or less voluminous pouch in which are found scarcely any traces of the renal parenchyma.

These pouches may attain a great size and present all the symptoms of large abdominal cysts, particularly those of the ovary. Confusion is sometimes almost inevitable, and the diagnosis can only be made when these cysts are punctured. It is quite possible then to find by analysis certain elements of the urine, particularly urea and urates.

For my part, I was witness of a case of this kind when I was clinical chief under Behier; it was a case of a woman who was believed to be affected with an ovarian cyst; the tumor was tapped, and the aspect and odor of the liquid leading us to examine it carefully, we then recognized the urinary origin of this sac. This woman, moreover, made a good recovery.

Finally, in certain very rare cases anuria has been observed, and in consequence thereof, uræmia, from obliteration of both ureters by calculi; recently my colleague and friend Tenesson has reported two cases of the kind. Here the medical treatment should consist in the use of diuretics on the one hand, and purgatives on the other, and it is necessary to vigorously combat both the anuria and the uræmic symptoms which are produced by the obliteration of the ureters.

Such are the accidents which may complicate lithiasis; I shall pass now to the study of the treatment of inflammations of the renal parenchyma, *i. e.*, to the treatment of the nephrites.*

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* Medical annals contain a number of cases of calculous anuria. Rayer, Anglada, Weber, Picard, Dumas in France; Abercrombie, Home, Paget, etc., in England; Naumann, of Bonn, Germany, have reported cases.

Two distinct periods may be studied in connection with the course of this affection; anuria without uræmia, and anuria with uræmia.

As for the cause of calculous anuria, it generally results

from the fact that one kidney has long ceased to perform its function, then there supervenes an obliteration by a calculus of the only ureter that remains.

In the first period, save the fact of the anuria, the patient preserves the appearances of health and continues his occupation, and does not seem to suffer; this period may last twelve to fourteen days, then uræmia sets in and the patient dies unless the obstacle is removed. Supplementary evacuations of urea take place by several emunctories and in particular by the intestine; lastly, among the symptoms of calculous anuria, Tennenson has remarked dropsy.

CHAPTER V.

TREATMENT OF THE NEPHRITES.

SUMMARY:—The Nephrites—Albuminous Urine—Tests for Albumen in the Urine—Tube Casts—Alterations of the Kidney in Bright's Disease—Division of the Nephrites—Amyloid Degeneration—Fatty Degeneration—Interstitial Nephritis, Lesions, Symptoms—Parenchymatous Nephritis—Pathogeny of the Nephrites—General Considerations on the Treatment of the Nephrites—The acute Nephrites—Their Treatment—Blood-Letting in Acute Nephrites—Revulsives—Dangers of Vesication—Treatment of Chronic Nephritis—Diuretics—Sudorifics—Purgatives—Acids and Astringents—Milk Diet—Oxygen—Raw Onions—Iodide of Potassium—Fuchsine—Nitro-Glycerine—Value of These Remedies—Indications in Chronic Nephritis—Treatment of the Albuminuria of Pregnancy—Conclusions.

GENTLEMEN:—I desire to complete these lectures on the treatment of diseases of the kidney by an exposition of the therapeutics of the nephrites. This is one of the most important subjects—if not the most important—in connection with renal diseases, and one which by its great frequency will often claim your earnest attention. But before entering upon this subject, it will be necessary to say a few words about albuminous urine,* which is one of the most frequent

*Albuminous urine is generally of pale color and feeble density. The quantity of albumen is never considerable; it may

accompaniments of acute or chronic phlegmasia of the kidneys.

Nothing is easier than to detect the presence of albumen in the urine. You know that we employ two processes, heat and nitric acid. Heat gives a whitish. opaque precipitate, with which you are familiar and which is well marked off from the rest of the liquid, if you have care to let the flame of the lamp play upon the upper stratum of urine in the test tube. The heat test, if employed alone, may lead you into a fallacy; the phosphates, in fact, under the influence of heat may cloud up the urine and give rise to a temporary deposit; hence the necessity of adding a drop of nitric acid after heating. Under the influence of the acid, the precipitate of phosphates disappears, and if albumen is present in the urine, it is precipitated in cloudy particles, which little by little settle down to the bottom of the test tube.

Nitric acid, if employed alone, also precipitates al-

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be less than one gramme per litre, and four or five gramme constitute a very large proportion.

The albumen found in the urine is identical with the albumen of the blood. Globuline has also been met in the urine of chronic nephritis (Lehmann). Globuline may in fact pass into the urine in greater quantity than albumen; clinical experimenters have noted as much, even, as an ounce per quart.

In albuminous urine there is always noticed a considerable diminution in the figure of urea-excretion, as well as of uric acid, extractives, and salts.

bumen, but it may in some cases be a cause of fallacy by giving rise to an abundant precipitate of urea. Hence the necessity of using both heat and nitric acid in testing urine for albumen.

Latterly the modes of testing for albumen have been carried to greater perfection. It is, in fact, very important, as you know, to be able to detect the least traces of albumen, and especially, to estimate the quantity; hence it is that clinicians have sought for ready methods of determining the amount of albumen in the urine. This is the object of the processes of Tanret and Luton, of Mehu, and especially of Esbach, which you have often seen me employ in this hospital.

Tanret's method is the double iodide of mercury and potassium test. The apparatus required is a glass tube graduated in cubic centimetres, and a dropping tube, and the two following liquids, a precipitating solution and test liquid:

NO. 1.—PRECIPITATING SOLUTION.

Potassii iodid., 3.22 grammes.
Hydrarg. bichlorid., 1.25 grammes.
Aquæ destillat., q. s. ad. 100 cub. cent.

NO. 2.—TEST LIQUID.

Hydrarg. bichlorid., 1 gramme.
Distilled water, q. s., ad., 100 cub. cent.

One drop of the precipitating solution precipitates 5 milligrammes of albumen.

Take ten cubic centimetres of urine, add 10 cubic centimetres of acetic acid, and pour in slowly, drop by drop, the precipitating solution. When the precipitate which first dissolved in an excess of albumen becomes stable, you watch and see,

after each new addition, if a drop, taken up on a pipette and placed in a porcelaine cup gives a yellow precipitate with a drop of the test liquid. When you have obtained this precipitate, you count the number of drops employed, then you subtract from this number the figure 3, and the remainder represents as many times 30 centigrammes of albumen per litre as you now have left of drops.*

[Mr. Guy Stephen's modification of this test is sufficient for all practical purposes. You first acidulate the urine with acetic acid, then add, drop by drop, the double iodide (see the above formula No. 1). This will give a precipitate when there is only one grain of albumen to a quart of water.]

Luton's test is based on the readiness with which an albuminous precipitate dissolves in a solution of tartaric acid. He measures exactly 10 cub. cent. of urine, and coagulates the albumen by heat in a test tube. Then he takes up in a pipette graduated in cubic centimetres and tenths of a centimetre a certain quantity of a solution of tartaric acid, of the strength of one gramme to 10 cub. centimetres; then he instills this solution, drop by drop, into the urine under examination, heating the mixture from time to time over a lamp, till the albuminous precipitate has entirely disappeared. He then reads off on the pipette the number of cubic centimetres of the solution or fractions of a centimetre, that have been used.

By this operation, frequently repeated, you obtain what Luton calls the *albuminimetric curve* of the patient, and you are enabled to determine whether the patient is getting better or worse, and the results of the treatment, (Luton, "On a New Method of Dosing Albumen," Union Med., Sept., 1879).

Mehu's quantitative method is called the phenic acid test. He makes use of the following solution:

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* Bull. Gen. de Ther., t. xcii, p. 308.

℞ Acid phenic, 10 grammes.
Acid acetic, 10 grammes.
Alcohol at 90°, 20 grammes.

M.

Measure out 100 cubic cent. of filtered urine; add 10 cubic cent. of the phenic solution, and 2 cubic cent. of nitric acid.

Wash the precipitate with boiling water saturated with phenic acid, dry at about the boiling point, weigh, and you have the weight of the albumen contained in 100 cubic centimetres.

Esbach has proposed two methods for the dosage of albumen, the one by the bulk of the precipitate, the other by the weight of the precipitate.

1. *Method by the bulk of the precipitate.*—Into a test tube graduated *ad hoc* called *albuminimeter*, you pour a given quantity of urine, and of the following reagent:

Acid picric. 10 grammes.
Acid citric (pure), 20 grammes.
Water, q. s. to make a litre.

M.

Turn the test tube upside down twelve times without shaking it, then close the mouth of the tube with a rubber stopper, and let it settle twenty-four hours, then you read off on the tube the number of degrees occupied by the precipitate; this is so regulated as to indicate the number of grammes contained in a litre of the urine.

2. *Method by weighing.*—In a flat-bottomed crucible, pour 20 cubic cent. of urine with 10 cubic cent. of the following reagent: Picric acid, 10 grammes; warm water, 1 litre. After solution and cooling, add: glacial acetic acid, 20 cubic cent. Heat the whole in a sea bath five minutes, and filter. The residue after filtration is evaporated to dryness over boiling water. To get the quantity of albumen, multiply the weight obtained by 0.8 (Bull. de thèrap., 86, p. 68).

It is not enough to know that there is albumen, you must also examine the urine under the microscope. This examination often reveals the presence of tube casts: epithelial, fatty, or hyaline, as the case may be (see the following figures), and according to the more or less profound alteration of these casts, we can judge of the progress of the lesion in the kidney. It is an autopsy, so to speak, made on the living patient, which enables you to recognize at sight the state of a part of the renal epithelium, which as I have told you, has an important rôle in the excretion of urine.

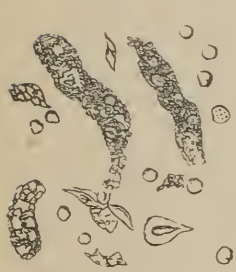

Fig. 5.

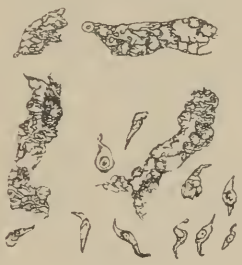

Fig. 6.

Fig. 7

The casts which are found in albuminous urine present four varieties: epithelial, hyaline, granular, and waxy.

1. *Epithelial casts.*—These are composed of agglomerated epithelial cells, and are only seen in the acute nephrites.

2. *Hyaline casts.*—They are transparent, colloidal, absolutely amorphous, and completely translucent. Their real composition is unknown. They are probably constituted by a protein substance which is not fibrine. Some think that they

are due to colloid transformation of the epithelial cells (Rindfleisch, Balfer), others to an exudation of blood serum. These tubes are seen especially in the acute periods of renal inflammations.

3. *Granular casts.*—These are large casts with granular epithelium, and are generally connected with fatty degeneration.

4. *Waxy casts.*—Large casts of a yellowish color, and waxy appearance; they have a great value in the diagnosis of chronic parenchymatous nephrits, and are seen, chiefly, in the advanced periods of Bright's disease.

Kelsch and Kiener have recently studied these casts, which they refer to three types: (1) Hyaline casts; (2) waxy and colloid casts; (3) opaque and granular casts.

The hyaline casts predominate in congestive states, the colloid in inflammatory states, and the opaque belong to chronic nephritis and to the fatty degeneration of the cachexias.

Having settled these preliminaries, let us now enter on our subject of the treatment of the nephrites.

Our knowledge of the nephrites has made considerable advances during the past few years, and the histological studies of the kidney have enabled us to recognize in their minutest details the disorders which inflammatory conditions inflict upon the renal gland.

The history of the kidney diseases since the labors of Bright, in 1831, to our day, shows the incessant progress which has been made in this part of pathology. If the therapeutics of these affections still leaves something to be desired, it must be recognized nevertheless that pathological anatomy and clinical observations have given us new light on the

state of the kidney, and on the influence which this state may have in the development of symptoms obscure and badly defined, and which it was impossible for us heretofore to assign to their proper place in our classifications.

This progress in the anatomo-physiological study of renal lesions has demonstrated this first point, that affections of the kidney may be accompanied with albuminuria without for that reason having an inflammatory origin, and, while some of these affections depend on a congestive or phlegmasic process, others are degenerations, more or less complete, of the kidney, which may go on without the participation of any hyperæmia.

The congestive or inflammatory lesions may attack three points of the renal-parenchyma: the epithelium, the uriniferous tube itself, and the connective tissue frame-work which surrounds it; whence arise three species of nephritis: epithelial nephritis, parenchymatous nephritis, and interstitial nephritis.

In the mildest degree, there is produced an abnormal desquamation of epithelium, and we have what is called *simple epithelial nephritis;* this it is that gives rise to that temporary albuminuria which accompanies febrile states, of however light a nature. It is an affection of no gravity, and demanding no treatment. We do not, in fact, treat the albuminuria which occurs at the onset of typhoid fever, nor that which accompanies certain phlegmasias, as pneumonia, for instance.

Quite different is that more profound inflammation of the uriniferous tube which produces, not only morbid changes in the epithelium of the canaliculi, and causes the formation there of fatty granules but also considerably alters their walls. We have here a more advanced degree of the malady, which is accompanied in most cases with an abundant albuminuria, and certain consequences which this loss of albumen by the urine entails. This is *parenchymatous nephritis.*

Besides this nephritis, there is another kind very important to know, which attacks, not the canaliculi, but the connective tissue frame-work of the kidney; this is *interstitial nephritis*, a nephritis which belongs to the great group of scleroses, a type of which we have studied among the liver diseases and diseases of the spinal cord.*

By the side of these lesions, there are others, as I have said, which do not result from an inflammatory process, and which, consequently, do not belong to the nephrites properly so called, but which may be accompanied with albuminuria, and manifest themselves during life, to the eye of the observer by most of the symptoms of Bright's disease; I refer to amyloid and fatty degenerations of the kidney.

The first is seen chiefly—as is the rule with the

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* Diseases of the Liver, Library Series, Chapter VI; Clinical Therapeutics (Detroit Edition), p. 182.

waxy degenerations—in cases of prolonged suppuration. I have before shown you, in connection with the liver and amyloid degenerations of that organ, the influence of suppurations, of syphilis, and of intermittent fevers; these same influences act on the kidney, and produce the same disorders.†

As regards fatty degeneration, it has another cause: it may accompany steatosis of other organs by overcharge of fat, but it generally depends on certain kinds of poisoning, and particularly on alcoholism. Alcohol, in fact, in passing through the liver and being eliminated by the kidneys, may produce two kinds of lesions: the one clearly inflammatory—interstitial hepatitis, interstitial nephritis, the other purely fatty—renal steatosis.

In this chapter, I intend to set forth the treatment of the nephrites properly so-called, but before entering on the exposition of the means to be used for this end, I must sum up briefly the symptoms of interstitial nephritis and of parenchymatous nephritis, and place before you, in all its widely differing details, a representation of the comparative symptomatology of these two renal inflammations.

In interstitial nephritis, the appearance of the kidney is characteristic; this organ is shrunken, contracted, presenting a lobular, irregular surface, this is the *small contracted kidney;* and when you examine the

† Diseases of the Liver, Chapter VI.

lesions under the microscope, you see that the connective tissue around the convoluted tubes has taken on an excessive development, and has choked out these tubes. The glomeruli, the essential part of the renal gland, are scarcely recognizable, and the divisions of the renal arteries which furnish the vessels constituting the glomeruli, have undergone alteration.

This alteration in the vessels is not limited to the kidney, and here is a point to which I wish to call your attention. In fact, an attentive examination of the arteries of persons suffering from renal sclerosis, shows that they are degenerated, from the heart to the capillary divisions. The lesions of the heart you are acquainted with; they have been described by Traube, and since then, thanks to the researches of Potain, we are enabled by the sole fact of disturbances in the rhythm of the heart, to diagnosticate in certain cases the existence of interstitial nephritis.

Several theories have been proposed to explain the vascular lesions which accompany interstitial nephritis. These may be summed up as follows: 1, *the renal affection is consecutive to the cardiac affection* (Rayer); 2, *the renal lesion is primary.* With regard to the latter hypothesis, we have the three following explanations:

(*a*) The hypertrophy of the heart is the consequence of the mechanical impediment to the circulation in the sclerosed kidneys (Traube.)

(*b*) It is the consequence of the increase of general arterial tension, due to spasm of the small blood vessels, resulting from the presence in the blood of materials destined to be eliminated by the kidneys.

(*c*) It is due to generalized lesions of the small blood vessels of the organism; this alteration constitutes the *arterio-capillary fibrosis* of Gull and Sutton.

Richard Toma maintains that in the actual state of science, we cannot know whether the lesions of the blood vessels are primary or consecutive.

I have said that certain rhythmical disturbances of the heart are valuable aids in the diagnosis of interstitial nephritis. There is a characteristic *bruit de galop* which attends these cases, and is dependent on alteration of the cardiac muscle, a morbid change which is hardly to be regarded as the consequence of a mechanical trouble in the outflow from the left ventricle, but is, according to Debove, the result of a primary fibrous degeneration of this ventricle, a degeneration which is synchronous with the interstitial alterations taking place in the kidney.

Potain thus describes the disturbance of the cardiac rhythm which supervenes in interstitial nephritis. We distinguish three bruits, namely, the two normal sounds of the heart, and a morbid bruit superadded. The two normal sounds preserve generally their habitual characters without modification. The first, in particular, keeps its ordinary relations with the shock of the apex, and with the arterial pulse. As for the abnormal bruit, it occurs immediately before the first sound, preceding it, however, by a brief pause, which is almost always shorter than the lesser pause. This bruit is much duller than the normal bruit. It is a shock, a perceptible heaving; it is hardly a real bruit. When the ear is applied to the chest, this bruit affects the tactile sensibility more perhaps than the auditory sense. If you attempt to hear it with a flexible stethoscope, it may happen that it shall disappear altogether. The point where it is perceived the best, is a little above the apex, and toward the right. But it may sometimes be distinguished throughout the whole extent of the precordial region.

With this bruit ordinarily coincides a heaving apparent to the hand, and which may even manifest itself to the enregistering instruments. This heaving is felt towards the middle of the precordial region, and a little below; but it is vague, diffused, and resembles in nothing the distinct impulse of the apex which ordinarily accompanies the first sound. With this bruit, the cardiac cycle is completed by three sounds of unequal length, and sometimes unequally distant, a rhythm which the ear seizes with extreme facility, provided it has once learned to detect it. This is the *bruit de galop*.

At the same time that this abnormal rhythm is detected, you discover almost always the signs of general hypertrophy of the heart without lesion of the orifice. There is seldom, in fact, any murmur indicative of such lesion.

The *bruit de galop* is distinguished from a reduplication of the first sound by three characters: 1. The superadded bruit differs absolutely, by its nature and its timbre from the normal bruit which precedes it. 2. The interval between them is always greater than that which separates the two parts of a reduplicated bruit, which is always formed of two similar bruits joined together in rapid succession. 3. The abnormal part of this bruit (the presystolic) by which the rhythm commences, always precedes the shock of the apex by an appreciable space, and coincides, moreover, with a distinct heaving, independent of this shock, while the reduplicated bruit makes itself always heard at the very moment when the apex of the heart gives its heaving impulse to the thoracic walls.*

With regard to the cardiac lesion which constitutes this bruit, Debove and Letulle have shown that it is a sclerosis of the columnæ of the left ventricle, which may affect, but to a less degree, the right ventricle. This cardiac sclerosis starts

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* Potain, "A Disturbance of the Cardiac Rhythm called *bruit de galop*."—(Memoire de la Soc. des hôpitaux, t. xii, 2d série, p. 137.)

in the blood vessels of the heart, and may be referred to periarteritis of these vessels. The hypertrophy of the heart and the interstitial nephritis are two distinct affections, often coinciding because they are due to a same lesion of nutrition. The bond which exists between the two processes is a sort of fibrous diathesis, which may equally affect other organs, as the liver, spleen, lungs and stomach.*

As for the arterial system itself, it is diseased, and the vessels of the lungs and especially those of the brain are also degenerated. Lancereaux and Peter attach a great importance to this intimate correlation, which you will often have occasion to note, existing between cirrhosis of the kidney and a profound alteration of the entire circulatory system.

It is because there is a general endarteritis, says Peter, that the left ventricle hypertrophies, by reason of its efforts to overcome the obstacle which the lesion opposes to the arterial circulation. It is because there is general endarteritis that there is renal endarteritis, and because there is renal endarteritis, there is interstitial nephritis.

During life, interstitial nephritis manifests itself by certain characteristic symptoms. Thus, the urine is very abundant, it is a veritable polyuria; but this urine is limpid, of light color, and when you examine its density, you see that it is always below 1020, and oscillates between 1005 and 1009. You find scarcely any traces of albumen, and it requires a good deal of

*Debove and Letulle, "On the Alterations of the Heart in Interstitial Nephritis," Arch. de Med. 1880.

experience to be able to detect a slight opalescence determined by heating. Grigg's metaphosphoric acid test is a delicate one in these cases; it causes a milky appearance when there is the least trace of albumen in the urine.

Again, there is often not a vestige of albumen in the urine, and in the same patient you may occasionally find a cloudiness of albumen, and on other occasions a complete absence of this element. If you seek for tube casts, you will not meet with any; if you dose the quantity of urea, as you ought always to do in such cases, you notice that the mass of urine contains but very little of it.

To these modifications of the urine, are joined very odd general symptoms. Certain patients have a persistent cephalalgia, others a dyspnœa which nothing can explain, some experience convulsive phenomena comparable to hystero-epilepsy, others present strange and irregular digestive troubles. With old patients there is often an itching of the skin which is a predominant symptom, a pruritus accompanied with desquamation like that of scarlatina. This pruritus and this exfoliative dermatitis should be ascribed to the renal insufficiency, and to the passage of the elements of the urine by the skin, which supplements the obstructed kidneys. At other times, there are cerebral troubles which present the strangest forms; sensorial hyperæsthesia, weakness of memory, general nervous excitation, etc.

All the symptoms which I have enumerated depend upon the renal insufficiency, which causes the toxic principles of the urine to accumulate in the blood, or to be eliminated by some supplementary emunctories.

All these varying and manifold symptoms which often break forth with great intensity, in order to be clearly diagnosticated, call for all the sagacity and experience of the physician, for, as I have before told you, these patients have little or no œdema, they make a great quantity of urine, and their urine often contains scarcely a trace of albumen. How many cases of death unexplained have resulted from interstitial nephritis? How many diseases have deceived the physician as to their true nature, and have been dependent exclusively on renal cirrhosis? The number is greater than you would suppose and such mistakes, constantly committed, result from this fact that physicians have always been in the habit of referring for the diagnosis of chronic nephritis to Bright's description, and have an idea that it is necessary, in order to be warranted in diagnosing this affection, to have general œdema and scanty urine which must be very albuminous. When these symptoms are not found, they seek elsewhere for the cause of the disease, and ascribe it by turns to other organs.

Such a mistake you ought never to commit, and whenever you notice severe disorders which a local condition can not explain, examine the urine, and if

you note a low density, if you detect troubles in the rhythm of the heart, be persuaded that it is to the kidneys that your investigations should be directed, and it is there that you should look if you would find the real origin of the symptoms which you observe.

Very different is the symptomatic picture of Bright's disease properly so-called, a disease which we describe to-day under the name of *parenchymatous nephritis*. Here, it is in the uriniferous tube itself that the lesion starts; there is first a tumefaction and a granulo-fatty degeneration of the epithelium; then the alterations affect the tube itself, and determine the aggregate of microscopic lesions characterizing Bright's disease.

The various lesions entail different symptoms which I will not describe, for you all know them; they are general anasarca, dropsies in the different visceral cavities, disorders of vision, lastly scanty urine containing flocculi of albumen in which the microscopic examination brings to view tube casts more or less altered.

Bright was the first to show, in 1827, that if the diseases of the heart, and if compression or obstruction by disease of the large blood vessels of the liver and of the veins may engender dropsy, they may also be the consequence of morbid changes in the kidney, and that in these cases the urine always contains albumen in greater or less quantity.

After the appearance of Bright's works other important memoirs, were published, by Christison, Gregory, Martin-Solon, Tissot, Sabattier, Rayer, etc., and confirmed the dis-

covery of the English physician. It then became the fashion in clinical practice to name as Bright's disease the complexus of symptoms described by Bright, and characterized by the presence of albuminuria, dropsy, and a renal lesion.

But to-day it is well demonstrated by microscopical researches, that the denomination of Bright's disease is not so restricted in its application as was once supposed, and ought to be considered only as a general term under which are grouped various lesions of the kidney, differing both in their seat and in their processes.

Albumen may, in fact, present itself temporarily under numerous influences: eruptive fevers, erysipelas, pneumonia, cholera, typhus, divers poisonings, and in all these cases the renal lesion is not precisely the same.

Authorities once considered as successive phases of the same disease, the divers lesions observed in the kidney, and referred the whole to Bright's disease. More definite ideas now prevail, and it is to chronic, permanent albuminuria, to diffuse parenchymatous nephritis, that the name of Bright's disease is applied at the present day.

For details as to the anatomo-pathological lesions in Bright's disease, I must refer you to the joint work of Cornil and Brault, who have given the most precise and recent data on this subject.*

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*They admit two great classes of nephrites: the diffuse nephrites, and the systematized nephrites. The first of these classes is sub-divided into: 1, acute nephritis, and 2, sub-acute and chronic nephritis. The systematized nephrites are also sub-divided into two groups: 1, the glandular nephrites (epithelial cirrhosis, glandular cirrhosis), and the vascular nephrites (vascular cirrhosis or sclerosis). (Cornil and Brault, Etude sur la pathologie du rein, Paris, 1884).

What is the first cause which determines the passage of albumen in the urine—that albuminuria which is the characteristic symptom of parenchymatous nephritis? This is a point very much in dispute, and which I must discuss at some length, in order that you may well understand the different kinds of treatment proposed for Bright's disease. We find ourselves in the presence of two parties: the anatomo-pathologists, on the one side, and the humorists, on the other.

The anatomo-pathologists maintain that it is the disorders of the kidney which favor the transit of albumen in the urine, and that when once this passage is effected, then all the symptoms characterizing Bright's disease ensue. According to this view, the least epithelial lesion suffices to give rise to albuminuria.

On the other hand, according to the humorists, Gubler, Jaccoud, Semmola, etc., it is in the blood that the first cause of the disease resides. They affirm that under a special influence, the albumen of the blood undergoes alteration or augments in quantity, and that it is this primary alteration of the albumen which favors its passage through the glomeruli. Gubler has been the most ardent advocate of this theory, in maintaining that there always exists, in cases of albuminuria, a true super-albuminosis, which leads him to compare Bright's disease to a special diabetes to which he has given the name of *leucomuric*

diabetes. But Semmola has given to this hypothesis an experimental confirmation by producing in animals alterations of the kidney as the result of injections of albumen under the skin.

Semmola's researches on Bright's disease and its pathogeny date from 1850. These are the principal conclusions of his various works:

1. Bright's albuminuria is the consequence of a particular dyscrasia which Semmola describes under the name of *Hetero-albuminæmia*, which denotes the formation of diffusible, unassimilable albuminoid substances.

2. The first cause of this alteration of the albuminoid substances of the blood resides in the diminution and suppression, more or less complete, of the respiratory functions of the skin.

3. The passage of albumen through the kidneys produces a morbid irritative process, which brings about a glomerulo-nephritis with granulo-fatty degeneration of the epithelium of the tubuli.

4. Bright's disease should be placed among the general dyscrasic maladies resulting from a disturbance of nutrition.

5. The anasarca is a disorder of chemical nature, and the diminution of urea results from a retardation of the oxidation processes of the albuminoid substances, by the cessation of the respiratory functions of the skin.

As treatment, Semmola proposes milk diet and starchy food, sudorifics, inhalations of oxygen, and the usage of a mixture which is to be taken freely as a drink, and which he calls his *anti-Brightic liquid*, of which the composition is as follows:

℞ Iodide of sodium, 1 to 2 grammes.
Phosphate of sodium, 2 to 3 grammes.
Chloride of sodium, 6 grammes.
Water, 1 litre.*

I have stated the two opposite views; between them exists a mixed theory which ascribes the disease

* Semmola, "New Experimental and Clinical Researches on Bright's Disease" (Arch. de Phys., 1884).

both to an alteration of the blood and an alteration of the kidney, simultaneously occuring.

Pardon me, gentlemen, this rather long exposition of the symptoms of the chronic nephrites. I have entered somewhat fully into the subject, as notwithstanding the numerous works which have appeared the past few years on these renal diseases, the symptomatology of the nephrites, and in particular of interstitial nephritis, is still little understood. Moreover, I have thought it my duty to give you briefly what is known respecting the pathogeny of parenchymatous nephritis, because this has a very marked influence on the various kinds of treatment which have been proposed for Bright's disease. I will, then, take up in their order all the various therapeutic agencies, and at the close will discuss the real value of each of them.

This part of my subject is a very difficult one to treat, for, as you will see, the therapeutic indications vary here according to the period of the disease, and a certain medicament which at the onset might have had untoward results, is on the contrary prescribed with advantage at a more advanced stage of the affection. There is not, in fact, any treatment of the nephrites, there are successive treatments of the acute and chronic inflammations of the kidney, and it is necessary that the physician, following step by step the progress of the disease, shall vary the choice of his remedies according to the diverse circumstances

supervening in the course of the affection. If certain medicines have at times been attended with success, and at others with failure in Bright's disease, it is because physicians have not been careful rigorously to determine at what period of the disease the medicament should be employed, but have administered it tentatively or at hap-hazard.

First of all, we must separate clearly, from a therapeutic stand-point, the acute from the chronic nephrites. In the acute period, which you will rarely observe, and which is characterized by severe pains in the renal region, by red and sometimes by bloody urine, by fever, in a word, by all the general and local symptoms characterizing an acute phlegmasia, you may have recourse to two great therapeutic means: the antiphlogistic method and the revulsive method.

If you open your old text books to the chapters on diseases of the kidneys and their treatment, and in particular the great work of Rayer, you will see that blood-lettings have been warmly advocated in acute nephritis; and by blood-letting is understood, not only general venesection, but also wet cups and leeches. I own that for my part I have never opened a vein for an attack of nephritis, however acute and intense it might have been, and I believe that I have reason on my side.

It is necessary to be very chary with spoliative means in patients affected with acute nephritis; this

inflammation, in fact, passes rapidly to a more advanced stage, and when once the renal alteration is established, you know how speedy is the consecutive alteration of the blood. I do not believe that it is prudent or reasonable to favor by phlebotomy this blood-change; it is not, moreover, proved that venesections, however free, are capable of arresting the inflammatory processes in the renal parenchyma which have for their consequence the ulterior morbid changes characterizing Bright's disease. While, then, absolutely rejecting general blood-letting, I cannot altogether condemn local abstractions of blood, and am free to admit that wet cups, five or six, for instance, applied over the renal region, have sometimes a good effect in causing rapid disappearance of the pain characterizing acute nephritis. You can also employ leeches, but they act less beneficially than cupping in relieving pain.

Among the revulsives, sinapisms and vesicatories have been advised. In this connection, it is well to take account of the disputes which have prevailed respecting the utility or danger of blistering in cases of nephritis. As blisters contain cantharides, and this substance when absorbed is eliminated by the kidneys, determining a more or less severe congestion of these emunctories, you see why authorities have been opposed to blisters in cases of renal hyperæmia, and this opposition seems to me well founded; in fact, I would advise you never to employ cantharidal vesication in

these active congestions of the kidney; and whenever you feel the necessity of resorting to revulsion over the region of the kidney, you should use either Gondret's pomade, or mustard plasters, ammoniacal vesicatories, or, better still, punctiform cauterizations by the thermo-cautery.*

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* Gondrets's pomade is made as follows:

℞ Mutton suet ... . 1 gramme.
Lard.... ... . 1 "
Strong liquor ammonia..... 2 "

Melt the suet and the lard over a sea-bath at a temperature of 50° C. in a wide-mouthed flask with an emery stopper; when the mixture is almost cool, add the ammonia, put the stopper in the flask and shake thoroughly, plunging the flask now and then into cold water, to hasten the cooling.

This pomade is rubefacient after four or five minutes of application, vesicant after eight or ten minutes, escharotic after fifteen or twenty minutes.

The ammoniacal vesicatory is prepared by soaking a thick piece of flannel or cotton wadding in strong water of ammonia, and applying it to the integument; vesication is produced in about ten minutes.

It is needless to say that cantharides, condemned by the author, has been recommended both for external and internal use by some authorities. Rayer speaks highly of the internal administration of tincture of cantharides for the dropsy consecutive to albuminous nephritis; his diuretic mixture is as follows:

℞ Infusion of horse-radish. 125 grammes.
Simple syrup ..... 16 "
Tincture of cantharides.. 8 drops.
Tincture of opium ..... 12 "

M. Make a mixture to be taken in three doses during the twenty-four hours.

But cantharides, if dangerous in recent inflammations, presents less of danger when you have to do with old renal lesions. Some have even proposed the internal administration of cantharides in the treatment of the chronic nephrites; it is hoped thereby to stimulate the functions of the kidney, and give at least a temporary activity to these emunctories. Without approving this treatment, which I believe dangerous and often inefficacious, I think, nevertheless, that in the advanced periods of Bright's disease, you may use with sufficient safety fly-blisters over the region of the kidneys.

Applications of iodine ought also to be rejected as a means of revulsion in acute nephritis. The interesting facts given by Jules Simon show that if, in the case of children, you apply for several days in succession tincture of iodine to the skin, you will bring on an attack of albuminuria, caused by the congestion of the kidneys resulting from elimination of iodine by the urine.

We come now to the most important part of this lecture, namely the treatment of chronic nephritis. When you take a general glance at the different therapeutic agencies proposed for Bright's disease, you see they may be arranged in three great groups.

In the first group are placed the medicinal measures proposed by those who would combat the symptoms resulting from the disorder in the urinary secretion, and who have advised therapeutic means directed

to the anasarca, the almost inevitable consequence of the albuminuria, or to the uræmic symptoms which so often accompany disturbance of the renal function. In another group, are placed medicaments designed to combat the disease, not in its principal symptom, but in the blood, considered as a first cause of the disorders observed.

Lastly, in the third group, the employment of the medicaments is not based on any physiological data, but is the product of empiricism. We will pass in review these several therapeutic agencies.

To combat the anasarca and the multiple consecutive effusions, to oppose the diminution of urine which is observed in chronic parenchymatous nephritis, to stay as far as possible the uræmic accidents, has long been the sole preoccupation of physicians called to treat Bright's disease, and in the combat with these symptoms, authorities have proposed the successive and even simultaneous use of diuretics, purgatives, and sudorifics.

Diuretics have had their advocates and their opponents. Some, as Frerichs, maintain that they can but congest the kidneys, and hurry on the phlegmasic processes of which these organs are the seat. Others, as Rayer, Christison, Gairdner, Dickinson, Lecorché, and especially Hirtz, who strongly defends the use of diuretics in Bright's disease, contend that this special action on the part of the kidneys has a salutary result. We thus obtain, say they, a veritable depletion of the

kidney, while at the same time combating the anasarca and its consequences. The success of these therapeutic agents depends, in fact, on the more or less advanced phase of the disease, and while at the onset, during the congestive period, diuretics are injurious, as we know that even in the normal state their usage may provoke albuminuria; at an advanced period of the disease, on the other hand, these remedies may do good.

You can employ all the diuretics which I have mentioned under the head of Cardiac Dropsies.* Christison prefers digitalis, Bright the decoction of uva ursi and horse-radish, Rayer, infusion of broom-top, Cazin, cleavers (galium aparini), Hirtz, squills, Roberts, tartrate of potash, Grainger Stewart, cream of tartar.†

*Diseases of the Heart, vol. I (Library Ed.), Chap. iii.

†Christison gave tincture of digitalis, 10 to 20 drops three times a day. He often associated it with cream of tartar; dose, one or two drachms stirred into water.

The *uva ursi* is best administered in the form of decoction (one oz. of the leaves to Oj of water). Dose, two or three wineglassfuls, three times a day. *Horse-radish* (*cochlearia armoracia*) is also given freely in the form of infusion. The same may be said of broom-top and cleavers.

Hirtz combined squills with tannin, and formulated the following pills:

℞ Ext. scillæ,
Tannin, ää 5 centigrammes.

M.—For one pill. Take from three to nine such pills per day.

Diaphoretics have been vaunted to remove the anasarca and restore the functional activity of the skin. However, despite the facts cited by Osborne, who is one of the most strenuous advocates of this kind of treatment, but meagre and uncertain results have thus far been obtained from sudorific agents in Bright's disease. Since the discovery of jaborandi, and especially since the introduction of pilocarpine into therapeutics, this question of the action of sudorifics in Bright's disease has taken more definite shape. At the time when the attention of the profession was first called to jaborandi and its wonderful diaphoretic properties, Gubler proposed to employ it in the treatment of chronic albuminuria. The first results obtained were not very encouraging; a little less albumen was indeed observed in the urine, and a little less œdema, but this gain was attended with such an enfeeblement of the forces, and such fatigue of the stomach, that the disease seemed rather aggravated than improved by the treatment.

Since the discovery of Hardy, who has enabled us to utilize pilocarpine, a part of these disadvantages has disappeared; in fact, this alkaloid when introduced under the skin produces in the dose of 2 c.gs. (about $\frac{1}{8}$ grain) profuse perspirations without any disturbance of the stomach, and it has often given good results. Langlet, of Rheims, Bruen, Cantieri, have reported numerous instances in its favor; but it is chiefly in cases of chronic albuminuria originating in

sudden variations of the temperature, as is witnessed in certain climates, that of Brazil, for instance, that this treatment by pilocarpine is efficacious. Dr. Costa, of Rio Janeiro, who has written a good treatise on Bright's disease and its treatment, insists on the great advantages which he has obtained from the employment of pilocarpine in Brazil.

Purgatives play a very important rôle in the treatment of chronic nephritis, and fulfil three great indications: First, in determining an irritation upon the intestinal mucous membrane, they produce a revulsion from the inflamed kidney; then in bringing about a hypersecretion from the glands of the intestine, they deplete the vascular system, and thus combat the anasarca and œdema which accompany the nephritis; lastly, and especially, they enable the solid and toxic matters of the urine, in cases of uræmia, to find a supplementary way of excretion. This last mode of action is in my estimation far the most important; this is why free purgation is especially beneficial in interstitial nephritis, and we may affirm that under the use of this means, if we cannot cure renal sclerosis, we may thereby greatly prolong the existence of the victims of this disease.

Whatever may have been the hypotheses which have been put forth to explain the intimate mechanism of uræmia, the fact none the less remains, that when the kidneys have become impermeable to the solid matters of the urine, and particularly, to the

azotized materials as well as the toxic products of the economy, the intestine appears to be the most favorable channel for the excretion of these materials. If there sometimes supervene, under the influence of this substitution of function, intestinal ulcerations, it must be borne in mind that generally this vicarious agency can be utilized without harm, and I cannot cite better instances in point than those curious facts recorded of hysterical anuria, where uræmic vomitings, and diarrhœa have supplied for months the suppressed renal function, and this without compromising the existence of the patients.

The same fact is often witnessed in both parenchymatous and interstitial nephritis, where we may by, purgatives administered properly, favor the intestinal excretion, and thus rid the economy of waste toxic elements which fail to be eliminated by the renal emunctory. Gubler preferred the saline to the drastic purgatives; the English physicians are partial to calomel; Martin Solon vaunts the oil of spurge and other drastics; Rosenstein, colocynth and gamboge; lastly, the emeto-cathartics which Gracia y Alvares employs in these cases of albuminuria, fulfil the same indication.

All the purgatives may be employed, the most energetic, as well as the mildest. When there are grave uræmic symptoms, it is necessary to have recourse to the former; when the symptoms are of less serious import, the milder cathartics may suffice, and

in the latter case, I advise you to resort to the saline purgatives. So, whenever your albuminuric patients complain of headache, or heaviness of the head, of marked mental sluggishness, of dyspnœa, or of any other of the multiple and variable symptoms which characterize uræmia, you should not hesitate to have recourse to purgatives, and this often and thoroughly.

When the functions of the kidney are suspended, or in any way considerably diminished, there appears a congeries of symptoms described under the name of uræmia and uræmic accidents.

These symptoms may have an acute or slow march, and affect the functions of the nervous system and the digestive tube. In the acute form, after having complained only of a few slight disorders of the sensibility, a little headache, vertigo, tinnitus aurium, vomiting, twitchings in the limbs, sometimes, also, without any prodrome at all, the patient is taken with epileptiform convulsions, then falls into coma.

The convulsive seizures manifest themselves under the form of eclamptic fits, supervening at variable intervals; in this convulsive form of uræmia, Jaccoud includes three clinical types; the epileptic type, the convulsive type, and the tetanic type.

The comatose form may be observed at the onset, or come on gradually, and be preceded by drowsiness, headache, hebetude, sometimes even by sub-delirium. When the coma is established, there is complete resolution of the limbs, but without paralysis; pulse is slow, pupils a little dilated; it is not very rare at the same time to observe slight convulsions and twitchings of the tendons.

After several hours, or even ten or fifteen days, of coma, the patient succumbs with a fall of temperature of one or two degrees.

In certain cases of uræmia following fatigue or excesses, the patient, perhaps quite healthy in appearance, is struck down suddenly, as by an attack of apoplexy, and dies without regaining consciousness. The importance of these forms, from a medico-legal point of view, and the mistakes to which they may give rise, are obvious enough.

The attacks of uræmia may also manifest themselves by delirium, by paroxysms of dyspnœa, sometimes accompanied with vomiting. Ortille, of Lille, has well studied this uræmic dyspnœa, and he has shown by his experiments on animals that this dyspnœa is linked to a state of suffering of the nervous system, determined by the retention of the products of disassimilation which the kidney no longer eliminates.

In the slow form, there are always prodromes, and this initial phase may last several weeks. The patient has a little headache, attacks of false migraine, then the headache increases, and its persistence would remind you of syphilitic cephalalgia. Attacks of vomiting are also observed, the phenomena undergo aggravation, and the disease may be considered as fairly established.

Besides these accidents on the part of the cerebro-spinal organs, uræmic patients have also digestive troubles; loss of appetite, difficult digestion, nausea, regurgitations, aqueous or alimentary vomitings, at first infrequent, then frequent, and incoercible. There is at the same time, diarrhœa, and the evacuations contain urea and carbonate of ammonia.

The fever is irregular, the skin dry and rugous, or covered with an abundant sweat, epistaxis is not of rare occurence.

[With regard to the treatment of uræmia by drastic purgatives, all agents of this nature have been advised in this affection. In the United States, the favorite cathartics in renal dropsy and uræmia seem to be croton oil (one drop in pill with bread-crumbs every two hours till free catharsis is induced); elaterium ($\frac{1}{12}$ grain every hour till full purgation); compound jalap powder (1 drachm p. r. n.); the compound

tincture of jalap (G.Ph.)—dose, a tablespoonful. The free use of cream of tartar water, large doses of Glauber salts, sometimes work admirably. Concentrated saline solutions (3 vj of sulphate of magnesia in a wineglassful of water for a dose) have been recently recommended.]

Quite different are the principles which govern the use of the therapeutic agencies of the second group. Before, it was the effects of the disease which it was desired to combat; here the endeavor is made to attack the very cause of the disease, and according as this is believed to depend on a primitive alteration of the blood or on primitive alterations of the kidneys, the treatment is different.

Those who hold to the humoral ideas, counsel four orders of medicaments; acids and astringents, milk diet, oxygen, and arsenic.

Forget, of Strasbourg, was the first to recommend nitric acid in the treatment of albuminuria. He thus took up again a treatment vaunted by Hausen and Labus. [The dose of the strong acid is about three drops well diluted, of the dilute acid, from 25 to 50 drops in some watery or mucilaginous vehicle.]

The English physicians, Sampson, Bayes, Scott Allison, Gairdner, and Wood prefer gallic acid to nitric acid; Garnier, Gubler, Tilling substitute for gallic acid tannin; they hope thus by the tannin to modify the molecular state of the albumen of the blood, and prevent its filtration through the kidney. The same notion caused Jacquet, Chatin and Hugues, of Lyons, to try the perchloride of iron. All these

medicaments, you must bear in mind, have had but a passing celebrity, and they are abandoned to day for two reasons: first, because it is doubtful if there are any conclusive observations of the cure of Bright's disease by these means,* and second, because we have found medicaments more active and more certain: milk diet and oxygen.

Oxygen in inhalations in some cases causes albumen to disappear from the urine, and this at the most advanced periods of the disease; and I shall never forget my astonishment at seeing, several years ago, in a patient to whom I had been called by Dr. Pisset, this result from oxygen inhalations; the patient was in the last stage of Bright's disease, and ready to succumb; there was an entire cessation of the albuminuria under the oxygen treatment, although the waste of albumen by the urine had previously been enormous.

What takes place in these cases? There is probably produced a modification in the blood which prevents the filtration of albumen; but this disappearance

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* Sampson gave gallic acid in albuminous nephritis in the dose of 50 cgs. (7½ grains) three times a day. Bayes raised the dose of gallic acid to 4 or 5 grammes a day.

Jacquet, Chatin, Hugues gave 20 drops of the tincture of perchloride of iron with seven grains of ergot of rye, and they increased the doses of these two medicaments up to 70 drops of the iron and 45 grains of the powdered ergot per diem

of albumen is rarely lasting, and generally, after a few weeks of improvement, the disease regains its ascendency, and the patient succumbs. This is what happened in our case.

However this may be, this favorable action of oxygen is one of the stock arguments of those who maintain that the anatomo-pathological lesions of the kidney play but a secondary part in albuminuria, since, though the lesions remain the same, we may, by a treatment addressed exclusively to the blood and to nutrition, cause the albumen absolutely to disappear. This peculiar action of oxygen was clearly shown several years ago by Eckart, Constantin Paul, and especially by Semmola, of Naples, who is, as you know. one of the most ardent advocates of the humoral doctrine in Bright's disease.*

* The applications of oxygen to therapeutics go back to the discovery of this gas. In 1791 Beddon, of Oxford, in a special establishment, caused patients to respire oxygen, and since then these inhalations have been in large use all over the world.

Numerous kinds of apparatus have been devised for the inhalations of this gas; the most common form is that of Limousin. It is a wash bottle in which the gas is passed through an aromatized water; this wash bottle is connected with a rubber bag in which the gas is kept. The source of the oxygen is a mixture of 100 grammes each of chlorate of potash and black oxide of manganese in a steel retort. The patient breathes from 10 to 15 litres of oxygen morning and evening.

If oxygen gives only a temporary benefit, there is another medicament which may give more permanent results; I refer to milk. It is certain that milk diet is acquiring an ever-increasing importance in therapeutics; you have heard me vaunt its efficacy in advanced cardiac affections; you have heard me maintain its advantages in chronic affections of the stomach and intestines; and recently in diseases of the liver, you have been told of the marvellous results which are often obtained by milk diet.* But it is especially in Bright's disease and in interstitial nephritis that we witness the benefits of this admirable aliment.† Milk acts here as a diuretic and as food; it modifies the albumen of the blood, and restores the functions of nutrition; if it does not always cure, it at least en-

* Diseases of the Liver; Library edition, page 94, 155.

† Lancereaux is in the habit of ordering ass's milk, or, where this can not be obtained, cow's milk that has stood twelve hours and been carefully strained. Of this, two quarts are given the first day with other food, the whole being taken in cupfuls at equal intervals—four times during the 24 hours. The next day the patient is made to drink three quarts, and all other food is withheld. The following day, the quantity is still further increased, to four or six quarts, as the patient can bear. To the milk may be added Vichy water, lime-water, calcined magnesia, as the patient may fancy or require; what seems to succeed best, is the addition of 1 or 2 drachms of common salt to each quart of the milk. If at the end of a week there is no improvement, the milk diet can be discontinued. Where this milk regimen suits, it can be kept up for five or six months.

ables the patient to live. Authorities, too numerous to mention (Jaccoud, Lancereaux, Guignier, Debove, Lemoyne, etc.), have shown that milk constitutes the principal therapeutic agency in Bright's disease, by means of which, renal diseases with albuminuria have lost half of their terrors.

Karell. of St. Petersburg, has justly maintained that the physician ought not to say to his patient simply: "Drink milk, as much as you can," but he ought to indicate and limit the quantity, the kind of milk, and the hours at which it should be ingested. You will, then, order your patient to take four times a day at carefully prescribed periods, from two to eight ounces of milk. If he cannot take the quantity all at once, follow the advice of Gallard, and give it to him in small quantities at a time, even if he has to get his cupful down by slow sips. Karell counsels skim milk; for my part, I prefer milk fresh from the cow.*

Certain physicians, and in particular Claudot, Pautier and Serre, of Alais, guided by preconceived notions which I cannot understand, have associated milk with raw onions.† I avow that to conjoin an uncertain medicament with one known to be active, to draw a therapeutic conclusion therefrom, seems to me to be a very unwarrantable method. I

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*Diseases of the Stomach and Intestines, p. 231.

†Onions, according to Cazin, have marked diuretic properties, and have been credited with beneficial effects in dropsies, Serre prescribes raw onions along with milk diet; the patient, besides his three meals of milk, eats freely of onions. He claims sixty cases of cure by this means.

have told you that milk diet of itself always ameliorates and sometimes cures Bright's disease, and I do not see how this result is to be helped by the addition of onion, an indigestible aliment, often very badly supported by the stomach, which is more likely to compromise than favor the good effects of milk diet. I advise you, then, to eschew this combination.

Arsenic belongs to the same group of medicaments, aiding by its action on nutrition the absorption of albuminoid matters (as has been shown by Semmola, Jaccoud, and Lauder-Brunton), especially at the period when the use of raw meat is made to succeed that of milk diet.

Thus far I have been occupied only with therapeutic agencies based on the humoral doctrines which have been advanced in explanation of the albuminuria. Those who place in the kidney the first cause of all the morbid accidents, have counseled other means. Some, as Croq, of Brussels, have vaunted iodide of potassium, Baudon, iodide of calcium, and Bourdon, iodide of starch; this latter preparation is very easily made; it suffices to pour from five to ten drops of tincture of iodine into a little starch water, and to make the patient swallow the whole.

Basing himself on opposite ideas, Semmola has recommended iodide of sodium and chloride of sodium as being likely to modify the state of the albuminoid substances of the blood, and he constitutes with the adjunction of phosphate of soda to these two salts, a

drink to which he gives the name of *antibrightic liquid*. (The formula may be found on page 127).

Iodine and the iodides have a direct action on the kidney. They are eliminated by this organ, and this elimination may as J. Simon has shown, provoke a veritable albuminuria. This local action, then, is here the dominant fact of the treatment. The same notions have caused the adoption of cantharides or cantharidin; it has been thought that the action of this alkaloid on the glomeruli, an action recently studied by Cornil, might stimulate the latter and give them a new vital activity.*

Finally, I have said that there is a kind of treatment having for its basis empiricism. Thus it is that fuchsine and nitro-glycerine have been advised.

In 1876 Feltz and Ritter studied in man the physiological action of fuchsine, and remarked that it caused the disappearance of albumen in a case of albuminous nephritis. They renewed their experiments, and concluded that this substance might be of service in the treatment of parenchymatous nephritis.

* Cornil has shown the intimate action of cantharidin on the kidney. This alkaloid determines a veritable albuminous pyelo-nephritis. In animals poisoned by cantharidin, we notice an extravasation of white and red globules from the blood vessels of the glomerule, a swelling of the capsule of the glomerulus and of the convoluted tubes, and infiltration by a liquid containing hæmatic granules; then an inflammation is observed of the straight and collecting tubes whose cells become irregularly polyhædric.

Since then, this medicament has been the subject of numerous studies; Bouchut, Dieulafoy, Divet, have tested it, and the results have been favorable in some cases, uncertain in others. I myself, in my hospital service have made large use of this medicament, and without partaking the enthusiasm of some, or the entire lack of faith of others, I have sometimes noticed, though rarely, a considerable diminution in the quantity of albumen excreted under the influence of fuchsine. I believe then that it is not altogether to be repudiated, and this for the greater reason that this medicine is always well borne.

You know that fuchsine is an oxidation product of aniline,* resulting from the hydrocarbons which come

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* Aniline (crystalline, kyanol, benzidam, phenic-amide, ammonia-phenyl, phenylamine) was discovered in 1826 by Unserdorben among the products of the distillation of indigo, and was extracted from tar products by Runge, and is to-day artificially obtained by Bechamp's or Zinin's process.

Aniline is a colorless liquid, aromatic, of acrid and burning taste. Its density is 1,028; it boils at 182°; exposed to the air it turns brown and resinous. Aniline is very soluble in water, alcohol and ether, fixed oils and volatile oils.

Verguin of Lyons in 1859, in acting upon aniline with anhydrous bichloride of tin, obtained fuchsine. It is prepared to-day by heating aniline to 150° or 160° with arsenious acid.

A solid body is obtained by this reaction which is soluble in acetic or hydrochloric acid, and which forms beautiful crystals, having the brilliancy of the scales of cantharides.

Fuchsine or rosaniline of commerce, always contains a

from the distillation of coal. In order to transform aniline into fuchsine, arsenic is used; it is also necessary if you prescribe this drug, to insist upon its purity. I advise you to administer this substance in capsules containing 0.25 gramme (about 4 grains) of pure fuchsine, giving two capsules during the day. You may also employ solutions of fuchsine, which present, however, the inconvenience of coloring the lips, teeth, and buccal cavity; an inconvenience avoided when the capsules are used.

Dr. Mayo Robinson, of Leeds, was the first to

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little arsenic. Employed in the arts for coloring tissues, candies, pasteries and wines, fuchsine, or hydrochlorate of rosaniline, has only been used in medicine for a few years, and this since the memoirs of Ritter and Feltz, of Nancy, and the researches of G. Bergeron and J. Clouet.

Feltz gave his patients fuchsine in solution or in pills; dose, 5 c. g. to 1 gramme. In this latter dose, at which he arrived in three successive days, Dr. Feltz saw diarrhœa ensue, and suspended the medicine.

In nearly every case, Feltz noticed the presence of a great quantity of phosphates in the urine shortly after the ingestion of the fuchsine, which he gave concurrently with the milk diet and sweating by the dry pack; his dose was three grains of fuchsine in a little mucilage and peppermint water.

Fuchsine is very rapidly eliminated; at the end of ten hours after the ingestion of a small dose, or at the end of several days when the medicament has been continued for some time. When the renal lesion is far advanced, fuchsine passes in great abundance into the urine, coloring it red.

advocate nitro-glycerine in the treatment of nephritis. He had already advised this substance for dyspnœa; he employed the nitro-glycerine in a one-per-cent. solution, and gave 60 cubic millimetres of this solution three times a day. This experimentation is yet too recent for us to decide as to its merits. With regard to the administration of nitro-glycerine or trinitrine, I refer you to what I have already said in my Diseases of the Heart, under the head of treatment of angina pectoris; here the same rules are applicable.

I have now brought to your attention most of the medicaments advised in chronic nephritis; I have tried to group them to the best advantage, in order to make this exposition as clear and practical as possible. It remains for me to tell you what kind of treatment you should choose, and what are the clinical indications which should lead you to have recourse to this or that therapeutic method.

The first point to establish, if you are called to treat a case of albuminuria, is to know if this affection corresponds to a grave condition of the kidney, or is only an accidental symptom. Here the indications furnished by examination of the urine, on the one hand, and the commemorative signs on the other, will put you in the way of the diagnosis.

As to the examination of the urine, the presence of tube casts, their more or less profound alteration, the quantity of albumen secreted, its nature and its retractility, as Bouchard has shown—all these signs

will enable you to tell if the symptoms are transient or are the indications of a lasting affection.*

As to the examination of the patient, it is the mode of onset of the affection, the symptoms which have preceded it, and those which it actually presents, which will enable you to recognize the true nature of this albuminuria.

If it is a condition of transitory catarrhal albu-

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*Bouchard has established the fact that the albumen of albuminous urines when coagulated by divers reagents, then submitted to the action of heat, sometimes retracts in flakes or in curdy lumps, which, at the moment of their shrinkage, allow the urine, which becomes again limpid, to pass completely outside of the coagulum. Sometimes it does not undergo this reaction, and the urine remains turbid and cloudy.

Albuminous urines with retractile albumen are the urines of all the nephrites and renal congestions. Albuminous urines with non-retractile albumen are found in grave acute diseases (scarlatina, puerperal fever, erysipelas, pneumonia), or in diabetes or chlorosis.

In typhoid fever generally albuminous urine is found to contain non-retractile albumen; but in some cases retractile albumen is found; this, according to Bouchard, is due to a parasitic nephritis, the result of elimination of bacteria by the urine.

Cazeneuve and Lepine have contested the absolute clinical value of the sign signalized by Prof. Bouchard, and they have alleged that in the same albuminuous urine, one may, by modifying the chemical medium, or rather the mineral medium, obtain easily the retractility or non-retractility of the albuminous precipitate. (Cazeneuve and Lepine, "On the Question of Retractile Albumen," Gazette Medicale, Dec. 11, 1880.

minuria, your rôle is very simple; it is confined to certain hygienic and dietetic measures. You should enjoin avoidance of cold, prescribe milk, promote the functions of the skin, and little by little the albumen will disappear from the urine. If it is a case, on the other hand, of acute nephritis, you may employ purgatives, and even wet cups if you discover the symptoms of a frankly inflammatory attack.

If, lastly, it is a case of grave alteration of the kidney, of a parenchymatous nephritis with anasarca, of Bright's disease, the treatment is more complex, and everything depends on the gravity of the symptoms of the patient.

Is the albumen in small quantity, one or two grams to the litre? Is the anasarca little pronounced, and more than all, is the affection of recent date? You should, in such a case, employ vigorously and persistently the most energetic means at your disposal. Order first of all an exclusive milk diet, of which you should carefully scrutinize the effects by a daily examination of the urine, and you should not allow a return to nitrogenous foods until the albumen shall have disappeared. You should add to this treatment, light purgatives, vegetable diuretics, and even subcutaneous injections of pilocarpine, if the patient is young and strong.

When the Bright's disease is more advanced, and the lesions of the kidney are so intense that a complete cure can not be expected, or when it is a case of

renal sclerosis, do not think that medical intervention is no longer necessary; you may be able in these very cases of absolute incurability to prolong the life of the patient, and this for a long time, by employing purgatives as soon as uræmic symptoms show themselves, by giving diuretics when the anasarca is considerable; finally by having a surveillance of the hygiene and alimentation of your patient.

In fact, there is a capital point which dominates the therapeutics of the diseases of the kidneys, a point upon which I can not insist too strongly, and which should always guide you in treating these affections, namely, that the pharmaceutical preparations and medicaments properly so-called hold a very small and subordinate place in the treatment of nephritis. I have already shown you the special intolerance to medicines which patients in Bright's disease present; it is necessary, then, to be very cautious in the use of drugs, and all your efforts should be concentrated in the inculcation of a hygiene well conceived and well directed.

This hygienic treatment should fulfil three indications: it should indicate the proper food, it should maintain as perfectly as possible the functions of the skin, finally it should enjoin the breathing of pure and bracing air.

When we see the predominating influence which diet has had in the treatment of diabetes since the excellent practical researches and directions of Bou-

chardat, there seems ground for astonishment that such a work has not been accomplished for albuminuria.

To know the influence of certain foods upon the excretion of albumen by the urine in the normal and pathological state, to find out what are the circumstances which permit the albuminous substances of the food to pass out in the urine, such is the problem the most important to solve in the treatment of Bright's disease. Unfortunately in this respect we have only a few rather uncertain indications.

We know, from the researches of Hamon, Brown-Sequard and Tessier, Barreswil, Claude Bernard, Stokvis, that we may by an exclusively albuminous diet * produce a true alimentary albuminuria. We know also that by intra-venous injections of albumen, Pavy and Claude Bernard arrived at the same results; we know, finally, by the investigations of Gubler, the influence of digestion upon the daily production of albumen, but all this is far from constituting a sum

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* Pavy has shown that when albumen is injected into a mesenteric vein, this albumen traverses the liver, heart, lungs and arterial system, before reaching the kidney.

Claude Bernard having eaten several hard boiled eggs after an abstinence from food for a prolonged period, found his urine albuminous.

Gubler in studying the urine of Bright's disease of both day and night, found always in that of the night a less quantity of albumen than in that secreted during the day.

total of data which will permit us to direct in a sure and precise manner the diet of Bright's disease.

Hamon* has well established a kind of classfication of foods in reference to their albuminogenous properties. Fonssagrives has made several attempts to establish the dietetic principles of this regime; lastly, Béchamp and Baltus have made more precise researches concerning the passage by the kidney of various albumens introduced by intra-venous injections, but this is still insufficient to be an exact

* Dr. Hamon has come to the following conclusions:

1. The influence of food on the excretion of albumen is very complex; it is necessary not only to take into consideration the nature of the food ingested, whether animal or vegetable, but also of the species from which it came, the amount consumed, the method and degree of cooking, the digestive conditions at the time, and individual idiosyncrasies.

2. Soft boiled eggs are very easily digestible, and exercise but a slight albuminogenic influence; when cooked hard, they have a contrary effect.

3. The vegetable kingdom does not admit of being classed in any such general manner with relation to albuminuria. Thus spinach, sorrel, cauliflower, herbaceous legumes in general, have no influence on albuminuria, while fibrous or dry legumes, refractory to digestion, such as beets, dry peas, potatoes, notably increase the excretion of albumen.

4. Milk, red wine or white, have no influence on albuminuria. It is the same with white bread, but coarse bread augments notably the quantity of albumen in the urine. Hamon places soft boiled eggs and brown bread at the two extremes of the scale. Coffee slightly augments the loss of albumen.

In their experiments upon dogs, Béchamp and Baltus

guide in the regulation of diet. Thanks to the labors of Bouchard and his pupil, Charrin, this question of diet in renal insufficiency is tending toward greater scientific definiteness. Charrin, on examining the different toxicity of urines, has shown that according to the period of digestion, and according to the nature of the food, urotoxine is increased or diminished. It is in this direction that we are to look for the basis of the diet-treatment of albuminuria.

As I have already shown in my lecture on alimentary hygiene,† we cannot quite compare diabetes to albuminuria. In fact, the quantity of albumen in the urine is no criterion of the gravity of the disease. A patient may pass an abundance of albumen, may get well, and present scarcely any symptoms of gravity, while another, whose urine contains scarcely any appreciable traces of albumen, may be seriously and

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have shown that the white of egg injected into the veins was excreted as white of egg. At the same time, the whole of the albumen injected was not eliminated. The serum of the blood of the cow was not eliminated by the urine, neither was gelatine so eliminated.

Albumen only of a particular kind when injected into the blood is eliminated by the urine; this albumen, Béchamp and Baltus call *sexplumbic*, (Béchamp and Baltus, Acad. des Sc. 1878. Hamon, Comptes Rendus de l'Acad. de Méd., April 29th, 1862.)

† Boston Medical and Surgical Journal, Vol. cxv, p. 513 (Lecture on Diet in Albuminuria), also the author's book; "L'Hygiene Alimentaire."

dangerously affected with renal lesions, and the symptoms may be exceptionally bad. The danger depends entirely on the elimination or non-elimination of the toxic products accumulated in the economy. We ought not then by diet to favor any further than may be necessary this accumulation of toxic substances, and it is probably in acting thus that milk is curative in the treatment of renal insufficiency.

Senator* has proposed empirically a purely vegetable diet, and for my part I believe, as I said in my "Alimentary Hygiene," that such a diet is often followed by good results, and I advise you to give it a trial. Your patient ought then to be kept on a purely vegetable diet, of which green vegetables should be

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*Senator has carefully studied the hygienic treatment of albuminuria, and particularly the diet. In regard to the quantity of food, he recommends the avoidance of hearty meals; the patient should take food often, but in small quantities. As to the quality of the food, he absolutely forbids the use of eggs in the nephrites. He also forbids the use of cheese and of wine; he recommends a vegetable diet. Those articles of food that are poor in albuminoids should be chosen, such as green vegetables, salads, fruits, etc. A limited quantity of fats may be allowed, provided the stomach tolerates them well. As for drinks, you should forbid brandy, whisky and other strong liquors, but red wine is allowed. Senator bases his preferences rather upon experience than upon scientific reasons. Beer increases the quantity of albumen and should be absolutely prohibited; the same is the case with spices and smoked foods. (Senator, Berlin Klin. Woch., Dec. 4th, 1882.)

the basis. You may add starchy and fatty food, while you should prohibit condiments and spices, and advise your patients to eat frequently, and but little at a time.

As to drinks, you should absolutely forbid wines and liquors, as well as beer, and when the patient, tired of milk, asks for a strengthening drink, you may prescribe red wines, and especially those which contain a marked proportion of tannin. It was by using broths, Bordeaux wine, and even Bagnols, that my preceptor Nonat established the tonic treatment of Bright's disease, a treatment which has given him good results.

The healthy performance of the functions of the skin, as I have already said, is the second important point in the hygiene of Bright's disease, Hence for a long time there have been advocated various methods for maintaining these functions in their integrity. You know too well the intimate relation which exists between the functions of the skin and those of the kidney not to realize the importance of such hygienic directions; therefore, authorities have long been in the habit of prescribing free sudation in Bright's disease, whether by hot-air baths (Kuss's method), or by vapor baths, or by the employment of hydrotherapy. Semmola has much insisted on these thermal and hydrotherapic practices; he prefers forced sweating in the hot-air chamber, which he follows by a general warm douche or a douche *en cercle;* he also uses warm

baths. In Germany Ziemssen, Liebermeister, Rosenstein, counsel the wet pack.

In Germany they make great use of baths and hydrotherapy in the treatment of Bright's disease. Rosenstein gives his patients baths at 28° or 29° R., then he wraps them in a wet sheet and covers them with a woolen blanket, and leaves them in this state two or three hours.

Liebermeister employs the following method, which is better:

The patient is placed in a bath at 37° C., and the temperature is gradually raised to 40° C.; at the end of half an hour, he is wrapped in woolen blankets previously heated, and allowed to remain in them two or three hours; then he is wiped dry and laid in a warm bed.

Ziemssen's method consists in wrapping the patient in a wet sheet wrung out of warm water; he is then covered with a dry blanket which completely envelops the whole body with the exception of the head, and if the head is inclined to flush, during the sweating process, compresses of cold water are applied to it, and hot-water bottles are put to the feet. (Ziemssen, Deutsch. Arch, f. klin: Med. Bd. II.

While not rejecting these therapeutic means, I think it best to be very chary in their employ. We must, in fact, avoid every cause of renal congestion, and in these applications of hot air and cold water which are in current practice in our *hammams* (sweating houses), it often happens that the least negligence entails an aggravation rather than an amelioration of the disease.

A few words about climate. What it is necessary to avoid in the case of patients suffering from Bright's

disease, is chilling of the cutaneous surface. You will then, when you can, send your patients to a warm climate where sudden changes of the weather are seldom or never experienced. Inhabitants of the north and northwestern states can sojourn to advantage in Southern California, the table lands of Mexico, or portions of the southern states, particularly the sea-coast regions of the Carolinas, or the highlands of Florida, where the air is not only warm, but abundantly supplied with oxygen.

In cases where sojourn during the winter in these countries is impossible (and such cases are unfortunately too numerous), you should enjoin your patient to be well protected by flannel garments, to wear wild-cat skin (with the fur) over the region of the kidneys, not to go out when the weather is too damp or too cold; in a word, to shun every thing which might too suddenly chill the body. Semmola would keep his patients in a warm room all winter long, and he insists on their living in large and well ventilated apartments where a constant temperature of 15 to 20° C. is kept up.

Such, gentlemen, are the principal indications to fulfil in the treatment of nephritis. Recovery, where the affection is chronic, is rare; but do not forget that in such cases, to prolong the life of your patient and render him comfortable is a result worth striving for, and you will be able to accomplish this by following the directions I have laid down.

The application of the doctrines of Pasteur to the study of the nephrites has enabled us to form a new group of these renal affections, under the name of *infectious nephrites*, affections which result from the passage through the kidneys of the microörganisms contained in the blood. Bouchard has shown the reality of these nephrites, but we have not yet, it must be admitted, therapeutic laws applicable to them.*

It may be asked if this elimination is not useful and necessary? We have, in fact, already seen that for the septic products absorbed from the surface of the intestine, elimination by the kidney is a physiological fact, for when this elimination ceases, there supervene toxic phenomena.

I have done with the treatment of renal affections, and despite the little extension which I have given to these chapters, I think, nevertheless, that I have supplied you with hints which you will find of greatest

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* Since the last publications of Prof. Bouchard, researches on the infectious nephrites have multiplied, and authorities have successively ranged among these nephrites, the albuminuria of typhoid fever, that of diphtheria, of erysipelas, of osteomyelitis, of scarlatina, in a word, all of the albuminurias complicating diseases developed by microörganisms (Bouchard on The Infectious Nephrites; Gaucher, Note on Infectious Diphtheritic Nephritis, and on The Pathogeny of Albuminuria in Diphtheria, etc.; Blechmann, on The Infectious Nephritis of Erysipelas of the Face; Mouret, on Infectious Nephritis Consecutive to Osteomyelitis, etc. The above are all of them communications to the learned societies, subsequent to 1881).

use in your practice; and if I have not touched upon the treatment of cancer and other degenerations of the kidney, it is because these diseases, which are, as you know, rebellious to therapeutics, do not furnish other indications than those which I have laid down under the head of hepatic affections.

In a future series of lectures, I shall take up the treatment of diseases of the lungs.

INDEX.

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